COOLING SYSTEM COMPONENTS, REMOVING AND INSTALLING

WARNING: When doing any repair work, especially in the engine compartment, due to the cramped conditions, pay attention to the following:

- Route all sorts of hoses/lines (e.g. for fuel, hydraulics, evaporative emissions system, coolant, refrigerant, brake fluid and vacuum pipes and hoses) and electrical wiring so that the original positions are restored.
- Ensure sufficient clearance to all moving or hot components.

NOTE:

- **When the engine is warm the cooling system is under pressure. If necessary, release pressure before commencing repair work.**
- **Hoses are secured with spring-type clips. In cases of repair only use spring-type clips.**
- **VAG 1921 pliers are recommended when installing spring-type clips.**
- **When installing coolant hoses route stress-free, so that they do not come into contact with other components (observe markings on coolant connection and hose).**

Perform cooling system leakage test with cooling system tester VAG 1274 and adapters VAG 1274/8 and VAG 1274/9.

- Parts of cooling system body side. See **COOLING SYSTEM COMPONENTS (BODY SIDE)** .
- Parts of cooling system engine side. See **COOLING SYSTEM COMPONENTS (ENGINE SIDE)** .
- Coolant hose connection diagram. See **COOLANT HOSE CONNECTION DIAGRAM** .
- Draining and filling with coolant. See **COOLING SYSTEM, DRAINING AND FILLING** .
- Coolant mixture ratios. See **COOLING SYSTEM, DRAINING AND FILLING** .

COOLING SYSTEM COMPONENTS (BODY SIDE)

NOTE: The following list refers to items in Fig. 1 .

1. **O-ring**
   - Replace if damaged
2. **Upper coolant hose**
   - Secured to radiator with retaining clip
   - Check securely seated
   - Coolant hose connection diagram. See **COOLANT HOSE CONNECTION DIAGRAM** .

3. **Junction piece**
4. **Engine Coolant Temperature (ECT) sensor -G62-**
5. **Connector**
6. **Upper coolant hose**
   - Secured to radiator with retaining clip
7. **Bracket**
   - Secured at intake air boot
8. **After-run coolant pump -V51-**
   - Continues to run up to 10 minutes after ignition is switched off
   - Checking. See **AFTER-RUN COOLANT PUMP -V51-, CHECKING**
9. **15 N.m**
10. **Coolant pipe**
    - Secured with retaining clamps at right long member
11. **To turbocharger**
    - Coolant hose connection diagram. See **COOLANT HOSE CONNECTION DIAGRAM** .
12. **10 N.m**
13. **Additional fan**
    - Only vehicles with optional equipment
14. **Fan ring**
15. **Retaining clip**
    - Check seated securely
16. **Coolant fan**
17. **Bracket**
    - For coolant fan connector
18. **Lower coolant hose**
    - Secured to radiator with retaining clip
    - Check to ensure seated securely
    - Coolant hose connection diagram. See **COOLANT HOSE CONNECTION DIAGRAM** .
19. **Air ducting**
20. **Coolant fan thermo switch -F18-, 35 N.m**
    - For electric fan

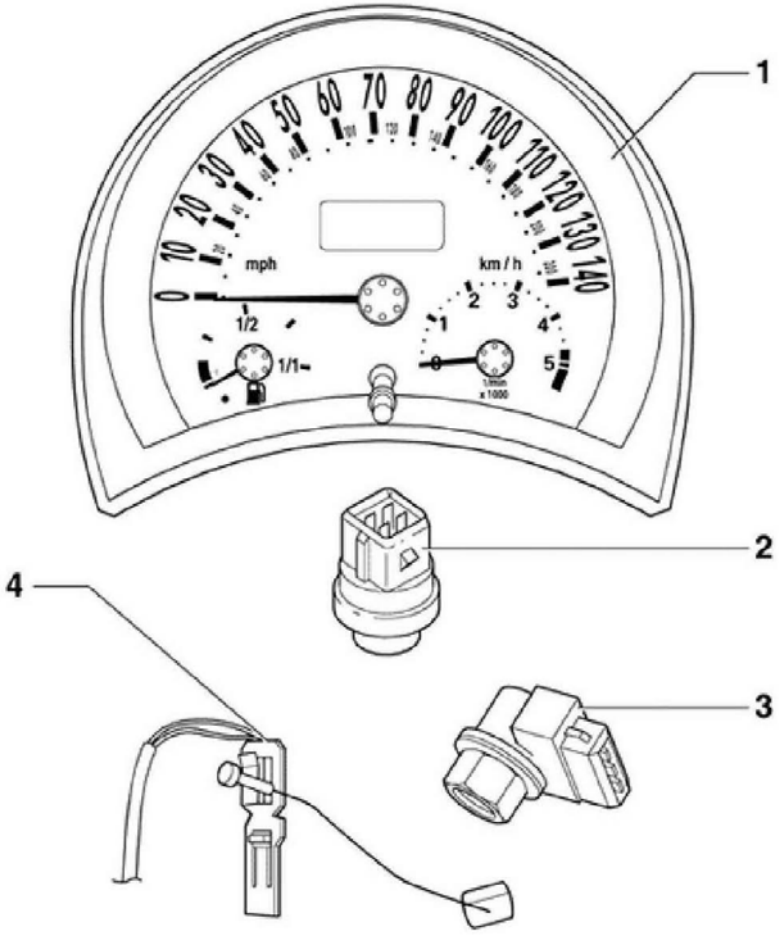
      Switching temperatures, stage 1:

    - on: 92 to 97° C
    - off: 84 to 91° C

      Switching temperatures, stage 2:

- on: 99 to 105° C
- off: 91 to 98° C

21. **Bracket**
    - For radiator
    - Note installation position
22. **Cooler**
    - Removing and installing. See **RADIATOR, REMOVING AND INSTALLING** .
    - After replacing replace all coolant



1 - Instrument cluster - K-

2 - Engine Coolant Temperature (ECT) sensor -G2-

3 - Speedometer Vehicle Speed Sensor (VSS) -G22-

4 - Sender for fuel gauge -G-

G03259900

Fig. 1: Identifying Cooling System Components - Body Side
Courtesy of VOLKSWAGEN OF AMERICA, INC.

COOLING SYSTEM COMPONENTS (ENGINE SIDE)

NOTE: The following list refers to items in Fig. 2 .

1. **15 N.m**
2. **Toothed belt**
   - Mark direction of rotation before removing
   - Check for wear
   - Do not kink
   - Removing, installing and tensioning. See **TOOTHED BELT, REMOVING, INSTALLING AND TENSIONING** .
3. **Coolant pump**
   - Check for ease of movement
   - If damaged or leaking replace complete
   - Removing and installing. See **COOLANT PUMP, REMOVING AND INSTALLING**
4. **O-ring**
   - Replace
5. **Coolant thermostat**
   - Checking: heat-up thermostat in water
   - Opening commences approx. 87 °C
   - Ends approx. 102 °C
   - Opening lift min. 7 mm
6. **O-ring**
   - Replace
7. **Connection**
8. **Hose to heat exchanger**
   - Coolant hose connection diagram. See **COOLANT HOSE CONNECTION DIAGRAM**
9. **Connector**
   - 4 pin
   - Up to MY 1999: Wiring chamber 1 and wiring chamber 3 for -G62-
   - From MY 2000: Wiring chamber 3 and wiring chamber 4 for -G62-
   - Gold plated terminals
10. **Engine Coolant Temperature (ECT) sensor -G62-**
    - With ECT sensor -G2-
    - For Engine Control Module
    - If necessary, release pressure in cooling system before removing
    - Checking:

      See Engine Coolant Temperature (ECT) Sensor, Checking

- Checking and erasing DTC memory:

  See Diagnostic Trouble Code (DTC) memory, checking and erasing

11. **O-ring**
    - Replace
12. **Retaining clip**
    - Check seated securely
13. **Connection**
14. **Upper coolant hose of radiator**
    - Secured to radiator with retaining clip
    - Check securely seated
    - Coolant hose connection diagram. See **COOLANT HOSE CONNECTION DIAGRAM**
15. **Lower coolant hose**
    - Secured to radiator with retaining clip
    - Check securely seated
    - Coolant hose connection diagram. See **COOLANT HOSE CONNECTION DIAGRAM**
16. **Upper coolant pipe**
    - Secured to intake manifold
    - Coolant hose connection diagram. See **COOLANT HOSE CONNECTION DIAGRAM**
17. **Cap**
    - Check with cooling system tester VAG 1274 and adapter VAG 1274/9
    - Test pressure 1.4 to 1.6 bar
18. **O-ring**
    - Replace if damaged
19. **Expansion tank**
    - Perform leak test of cooling system with cooling system tester VAG 1274 and adapter VAG 1274/8
20. **10 N.m**
21. **Coolant pipe**
    - Secured to oil filter bracket
    - Coolant hose connection diagram. See **COOLANT HOSE CONNECTION DIAGRAM**
22. **Oil cooler**
    - Removing and installing. See **PART II** , item 22
23. **15 N.m**

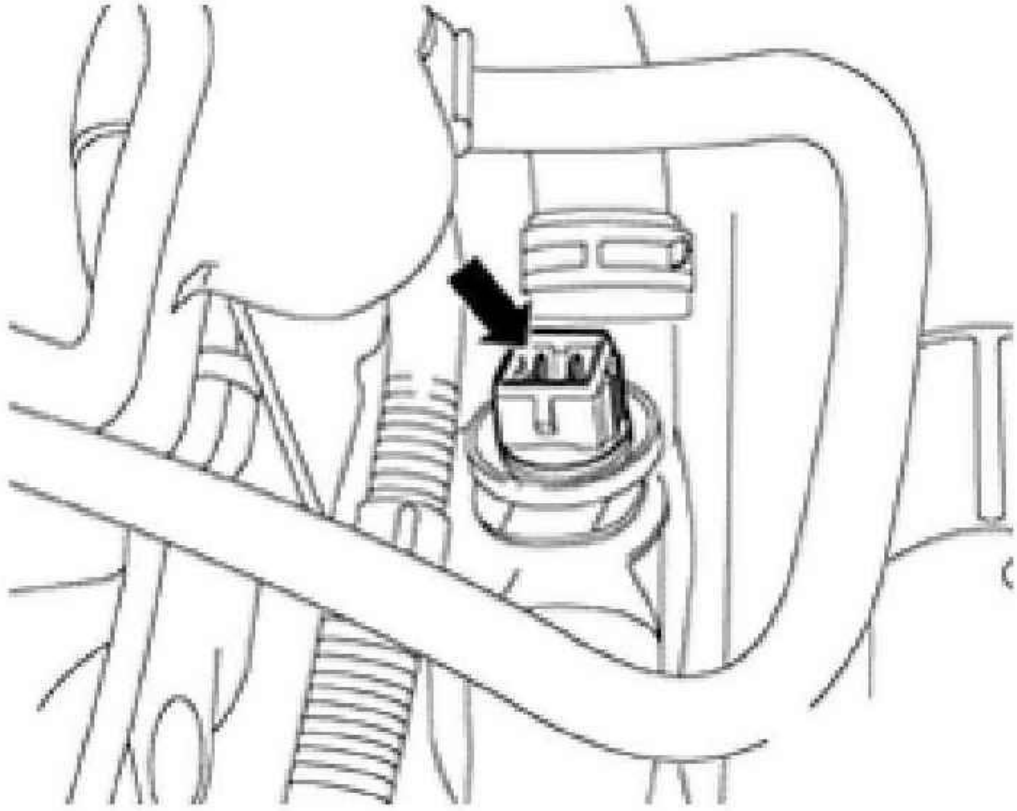


Fig. 2: Identifying Cooling System Components - Engine Side
Courtesy of VOLKSWAGEN OF AMERICA, INC.

COOLANT HOSE CONNECTION DIAGRAM

Only vehicles with engine code APH

Vehicles with engine codes AWP, AWV: See **Vehicles with engine codes: AWP (only manual transmission), AWV (manual and automatic transmission)** .

NOTE: The following list refers to items in Fig. 3 .

1. **Expansion tank**
2. **Turbocharger**
3. **Intake manifold**

4. **Cylinder head/cylinder block**
5. **Heating system heat exchanger**
6. **Coolant pipe**
7. **ATF cooler**
    - Only on vehicles with automatic transmission
8. **Oil cooler**
9. **Upper coolant hose**
10. **Cooler**
11. **Lower coolant hose**
12. **After-run coolant pump -V51-**
13. **Coolant pump/coolant thermostat**

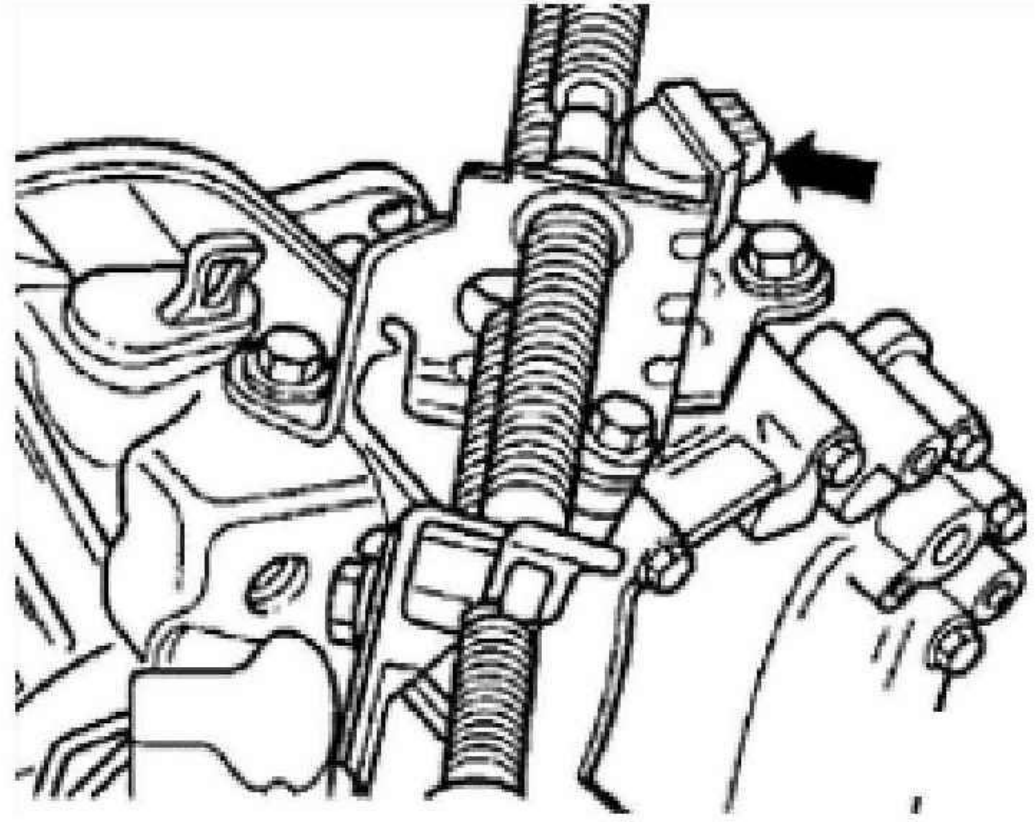


Fig. 3: Coolant Hose Connection Diagram - Engine Code APH

Courtesy of VOLKSWAGEN OF AMERICA, INC.

Vehicles with engine codes: AWP (only manual transmission), AWV (manual and automatic transmission)

NOTE: The following list refers to items in Fig. 4 .

1. **Expansion tank**
2. **Turbocharger**
3. **Intake manifold**
4. **Cylinder head/cylinder block**
5. **Upper coolant pipe**
6. **Connection**
7. **Heating system heat exchanger**
8. **Lower coolant pipe**
9. **ATF oil cooler**
    - Only on vehicles with automatic transmission
10. **Oil cooler**
11. **Upper coolant hose**
12. **Drain plug**
13. **Radiator**
14. **Lower coolant hose**
15. **After-run coolant pump -V51-**
16. **Coolant thermostat housing**
17. **Coolant pump**

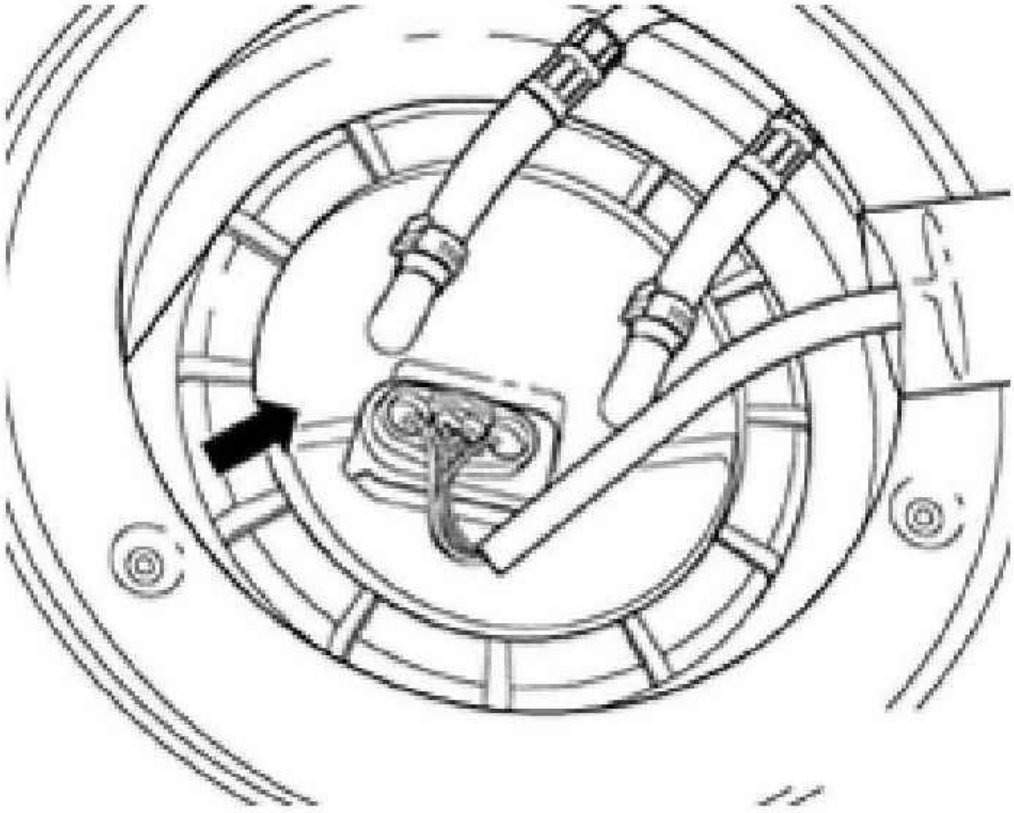


Fig. 4: Coolant Hose Connection Diagram - Engine Code AWP, AWV
Courtesy of VOLKSWAGEN OF AMERICA, INC.

COOLING SYSTEM, DRAINING AND FILLING

Special tools and equipment

- T10007 Refractometer
- VAG 1306 Drip tray
- VAS 5024 Assembly tool for spring-type clamps

Fig. 5: Identifying Special Tools And Equipment
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Draining

WARNING: Steam can be released when removing the cap from the expansion tank. Cover cap with a cloth and open carefully.

- Open cap on coolant expansion tank.
- Remove center insulation tray:

  See **PLENUM CHAMBER SEALING ASSEMBLY, REMOVING AND INSTALLING** .

- To drain coolant from radiator remove drain plug -arrow-.

Fig. 6: Draining Coolant From Radiator By Removing Drain Plug
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- To drain coolant from engine also remove coolant hose from oil cooler -arrow-.

Fig. 7: Draining Coolant From Engine And Removing Coolant Hose From Oil Cooler
Courtesy of VOLKSWAGEN OF AMERICA, INC.

NOTE: Observe disposal regulations!

Filling

- Only use coolant additive G 12 in accordance with TL VW 774 D. Identification: colored red.
- On no account must G 12 be mixed with other coolant additives!
- If the fluid in expansion tank is brown, G 12 has been mixed with other coolant. In this case the coolant must be changed.
- G 12 and coolant additives marked "In accordance with TL VW 774 D" prevent frost and corrosion damage, scaling and also raise boiling point of coolant. For this reason the system must be filled all year round with frost and corrosion protection additives.
- Because of its high boiling point, the coolant improves engine reliability under heavy loads, particularly

in countries with tropical climates.

- Protection against frost must be assured to about -25° C (-13° F) (in arctic climate countries to about -35° C (-31° F)).
- The coolant concentration must NOT be reduced by adding water even in warmer seasons and in warmer countries. The anti-freeze ratio must be at least 40%.
- If for climatic reasons a greater frost protection is required, the amount of G 12 can be increased, but only up to 60% (frost protection to about -40°C (-40°F)), as otherwise frost protection is reduced again and cooling effectiveness is also reduced.
- The T10007 refractometer is recommended for determining frost protection density.

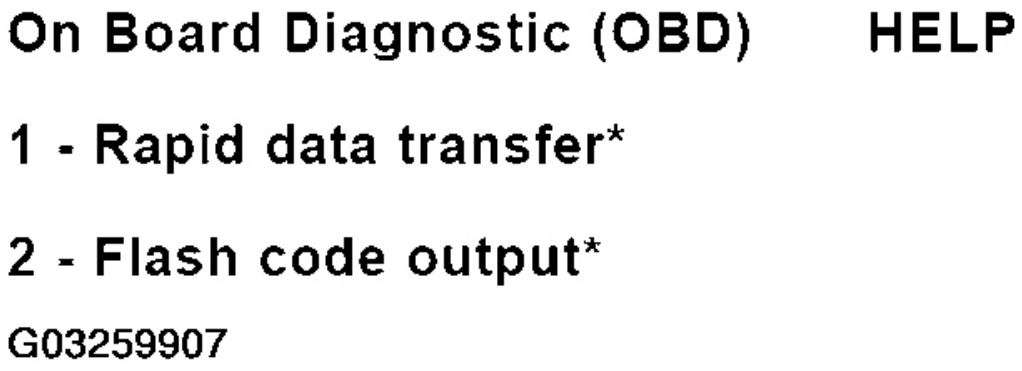


Fig. 8: Identifying T10007 Refractometer
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- If radiator, heat exchanger, cylinder head or cylinder head gasket is replaced, do not reuse old coolant.

Recommended mixture ratios:

RECOMMENDED MIXTURE RATIOS

Frost protection to	Antifreeze amount	G12 (1)	Water (1)
-25°C (-13°F)	40%	2.0 ltr. (0.5 gallon)	3.0 ltr. (0.8 gallon)
-35°C (-31°F)	50%	2.5 ltr. (0.7 gallon)	2.5 ltr. (0.7 gallon)
(1) The quantity of coolant can vary depending upon the vehicle equipment.			

- Screw drain plug into radiator.

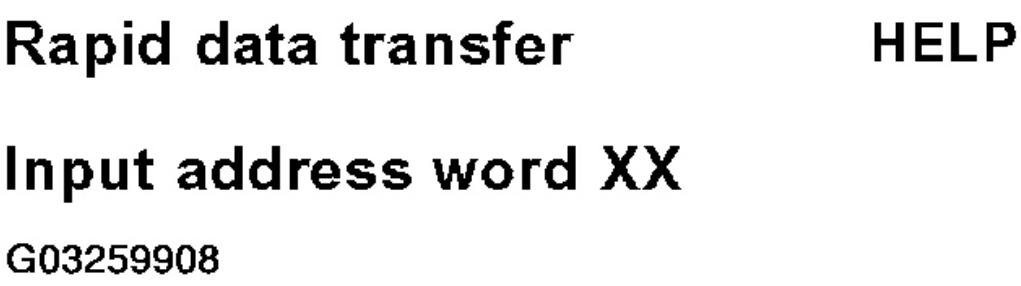


Fig. 9: Screwing Drain Plug Into Radiator
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Push coolant hose onto oil cooler connection and secure with a spring-type clamp.

Fig. 10: Pushing Coolant Hose Onto Oil Cooler Connection And Securing With Spring-Type Clamp
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Vehicles through Model Year2001

- Fill with coolant up to max. mark on expansion tank.

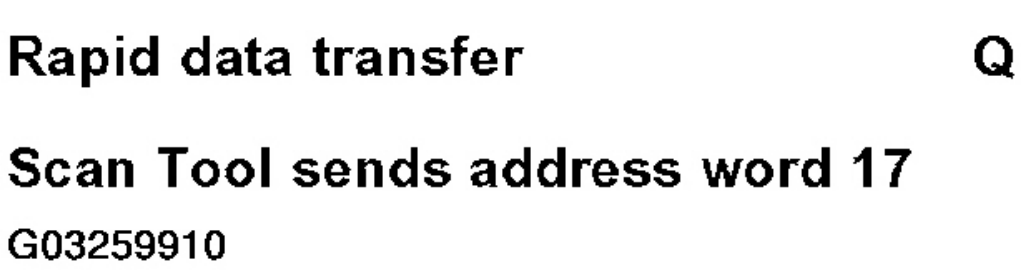


Fig. 11: Identifying Max. Mark On Expansion Tank
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Vehicles from Model Year 2002

- Slowly fill expansion tank to upper marking of shaded field with coolant.

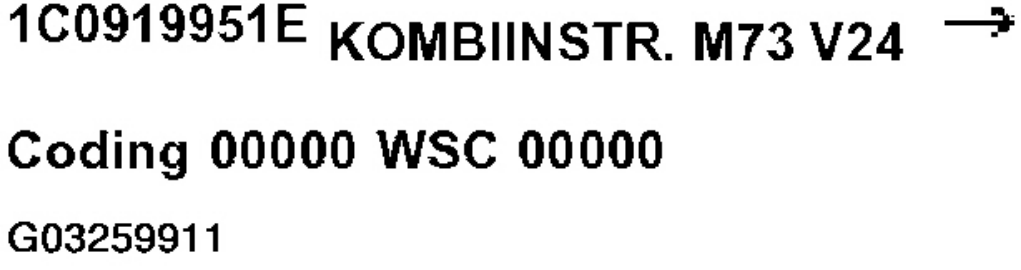


Fig. 12: Filling Expansion Tank To Upper Marking Of Shaded Field With Coolant
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Continuation for all vehicles

- Install expansion tank cap.
- Switch off heater and air conditioner.
- Start engine and maintain an engine speed of about 2000 RPM for approx. 3 minutes.
- Run engine until coolant fan cuts-in.

WARNING: Steam can be released when removing the cap from the expansion

tank. Cover cap with a cloth and open carefully.

- Check coolant level and top-off if necessary.

Vehicles through Model Year2001

When the engine is at normal operating temperature, the coolant level must be on the max. mark.

When the engine is cold, the coolant level must be between the min. and max. marks.

Vehicles from Model Year 2002

When the engine is at normal operating temperature, the coolant level must be at the upper marking of the shaded field.

When the engine is cold, the coolant level should be at approximately the middle of the shaded field.

RADIATOR, REMOVING AND INSTALLING

Special tools and equipment

- VAG 1306 Drip tray
- VAG 1331 Torque wrench (5 to 50 N.m)
- VAG 1921 Spring-type clip pliers
- Anti-freeze tester

Fig. 13: Identifying Special Tools And Equipment
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Removing

- Drain coolant. See **DRAINING** .
- Remove front bumper.

  See **FRONT FENDER, ASSEMBLY OVERVIEW** .

- Pull coolant hoses off radiator.
- Pull connectors off thermo-switch and coolant fan.
- Remove tensioning element for ribbed belt. See **RIBBED BELT TENSIONER, REMOVING AND INSTALLING** .
- Remove radiator securing bolts and take out radiator.

NOTE: Vehicles with air conditioner:

- Observe additional information and removal work. See **ADDITIONAL INFORMATION AND REMOVAL WORK ON VEHICLES WITH AIR CONDITIONER** .

Installing

Installation is carried out in the reverse order; when doing this note the following:

Filling with coolant. See **FILLING** .

Additional information and removal work on vehicles with air conditioner

WARNING: The air conditioner refrigerant circuit must not be opened.

NOTE: To prevent damage to condenser and also to the refrigerant lines/hoses, ensure that the pipes and hoses are not stretched, kinked or bent.

- Repair retaining clamps of coolant lines if necessary.
- Secure radiator at chassis before removing lock carrier.
- Remove condenser from radiator and secure to lock carrier.
- Secure condenser at chassis for removal of radiator.

COOLANT PUMP, REMOVING AND INSTALLING

Special tools and equipment

- VAG 1306 Drip tray
- VAG 1331 Torque wrench (5 to 50 N.m)
- VAG 1921 Spring-type clip pliers
- Anti-freeze tester

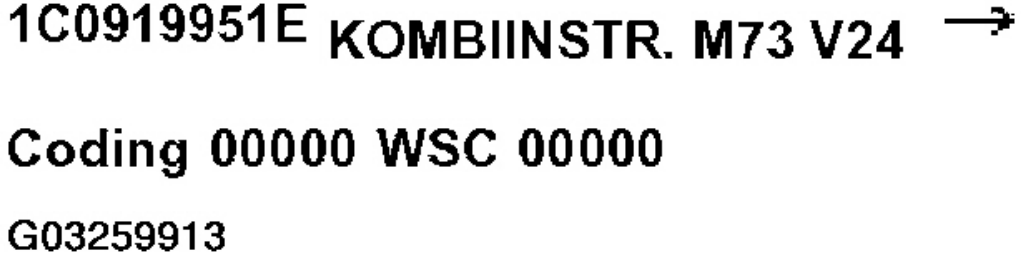


Fig. 14: Identifying Special Tools And Equipment
Courtesy of VOLKSWAGEN OF AMERICA, INC.

NOTE:

- **Always replace seals and gaskets.**
- **The lower part of the toothed belt guard need not be removed.**
- **The toothed belt should be left in position on the crankshaft sprocket.**
- **Cover toothed belt with a cloth to protect it from coolant before removing coolant pump.**

Removing

- Drain coolant. See **DRAINING** .
- Remove ribbed belt. See **RIBBED BELT TENSIONER, REMOVING AND INSTALLING** .
- Remove upper and center toothed belt guard. See **TOOTHED BELT, REMOVING, INSTALLING AND TENSIONING** .
- Take toothed belt off coolant pump toothed belt sprocket. See **TOOTHED BELT, REMOVING, INSTALLING AND TENSIONING** .
- Unscrew coolant pump securing bolts -1- and remove coolant pump -2-.

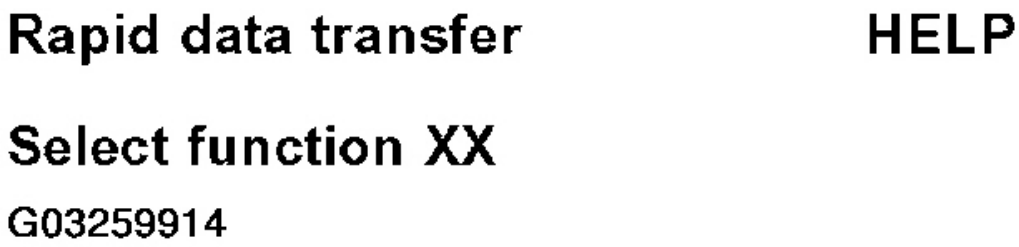


Fig. 15: Unscrewing Coolant Pump Securing Bolts And Removing Coolant Pump
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Installing

Installation is carried out in the reverse order; when doing this note the following:

- Moisten new O-ring with coolant.
- Insert coolant pump into cylinder block and tighten securing bolts.

  Tightening torque: 15 N.m

- Install toothed belt and adjust valve timing. See **TOOTHED BELT, REMOVING, INSTALLING AND TENSIONING** .
- Install ribbed belt. See **RIBBED BELT TENSIONER, REMOVING AND INSTALLING** .
- Filling with coolant. See **FILLING** .

THERMOSTAT, REMOVING AND INSTALLING

Special tools and equipment

- VAG 1306 Drip tray
- VAG 1331 Torque wrench (5 to 50 N.m)
- VAG 1921 Spring-type clip pliers
- Anti-freeze tester

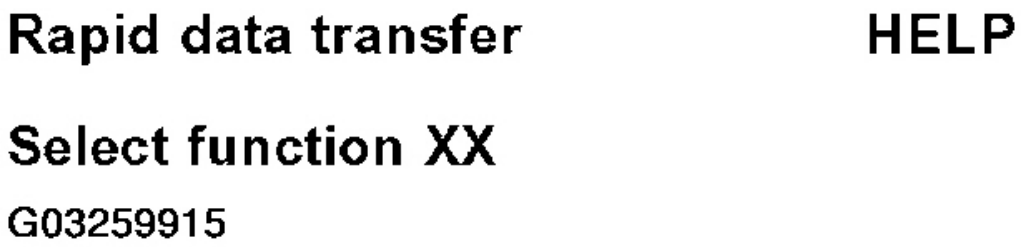


Fig. 16: Identifying Special Tools And Equipment
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Removing

NOTE:

- **Always replace seals and gaskets.**
- **Drain coolant. See DRAINING .**

Vehicles with air conditioner: Observe additional information and removal instructions. See **ADDITIONAL INFORMATION AND REMOVAL INSTRUCTIONS FOR VEHICLES WITH AIR CONDITIONER** .

- Pull coolant hose off connecting flange -3-.
- Unbolt securing bolts -4- of connecting flange -3- and remove connecting flange -3- with thermostat -1-.

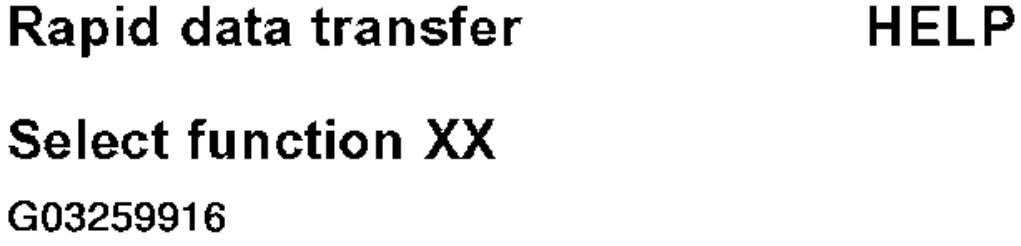


Fig. 17: Unbolting Securing Bolts Of Connecting Flange And Removing Connecting Flange With Thermostat
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Installing

Installation is carried out in the reverse order, when doing this note the following:

- Moisten new O-ring -2- with coolant.
- Insert thermostat -1- into connecting flange -3- and turn 1/4 turn (90°) to right.
- Install connecting flange -3- with thermostat -1- into engine block.

NOTE: The brace on the thermostat must be almost vertical.

- Tighten securing bolts -4-.

  Tightening torque: 15 N.m

Fig. 18: Tightening Securing Bolts
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Fill with coolant. See **FILLING** .

AFTER-RUN COOLANT PUMP -V51-, CHECKING

Special tools and equipment

- VAG 1527 B LED test light

Fig. 19: Identifying VAG 1527 B LED Test Light
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- VAG 1594 A Auxiliary test set
- Wiring diagram

Fig. 20: Identifying VAG 1594 A Auxiliary Test Set
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Checking conditions

- Fuse No. 16 OK.

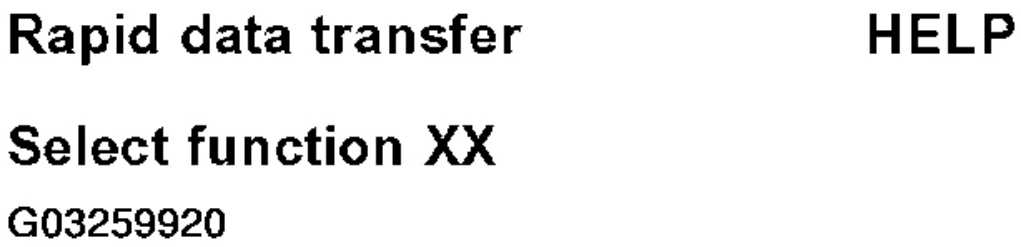


Fig. 21: Identifying Fuse No. 16
Courtesy of VOLKSWAGEN OF AMERICA, INC.

NOTE: Fuse box is located behind access panel at far left end of dash.

Test sequence

- Pull 2 pin connector off After-run coolant pump -V51 -.
- Connect contacts of After-run coolant pump -V51- to battery using auxiliary cables from VAG 1594.

  After-run coolant pump must run.

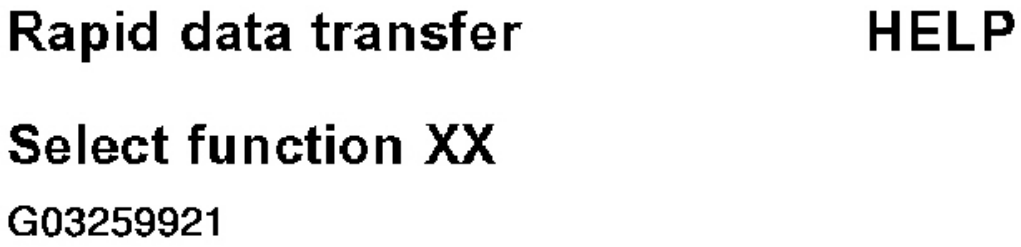


Fig. 22: Connecting Contacts Of After-Run Coolant Pump To Battery
Courtesy of VOLKSWAGEN OF AMERICA, INC.

If the after-run coolant pump does not run:

- Replace after-run coolant pump -V51-.

If the after-run coolant pump -V51- runs:

- Switch ignition off and on again.
- Connect LED test light VAG 1527 B to disconnected connector for After-run coolant pump -V51- with auxiliary cable from VAG 1594 A

  LED must light up.

NOTE: This check must be performed within 10 minutes of switching ignition off.

LED does not light up:

- Locate and repair open circuit using wiring diagram:

  See appropriate WIRING DIAGRAM article.

COOLING SYSTEM COMPONENTS, REMOVING AND INSTALLING

CAUTION: When performing repair work, especially due to the confined conditions in the engine compartment, pay attention to the following:

- **Route all types of hoses/lines (e.g. for fuel, hydraulics, EVAP system, coolant, refrigerant, brake fluid and vacuum) as well as electrical wiring so that the original positions are restored.**
- **Ensure sufficient clearance to all moving or hot components.**

NOTE:

- **When the engine is warm, the cooling system is under pressure. If necessary, release the pressure before beginning repair work.**
- **Hoses are secured with spring-type clips. In case of repair, only use spring-type clips.**
- **Assembly tool VAS 5024 or hose clip pliers V.A.G 1921 are recommended for installing spring-type clips.**
- **When installing coolant hoses, route stress-free so that they do not come into contact with other components (observe markings on coolant connection and hose).**

Perform cooling system leakage test with cooling system tester V.A.G 1274 and adapters V.A.G 1274/8 and V.A.G 1274/9.

Cooling system components - body side. See **COOLING SYSTEM COMPONENTS - BODY SIDE** .

Cooling system components - engine side. See **COOLING SYSTEM COMPONENTS - ENGINE SIDE** .

Coolant hose connection diagram. See **COOLANT HOSE CONNECTION DIAGRAM**

Draining and filling with coolant. See **COOLANT, DRAINING AND FILLING** .

Coolant mixing ratios. See **COOLANT, DRAINING AND FILLING** .

COOLING SYSTEM COMPONENTS - BODY SIDE

NOTE: The following list refers to items in Fig. 1 .

1. **Radiator**
   - Removing and installing. See **RADIATOR, REMOVING AND INSTALLING**

- After replacing, replace entire quantity of coolant

2. **O-ring**
   - Always replace
3. **Upper coolant hose**
   - Secured to radiator with retaining clip
   - Coolant hose connection diagram. See **COOLANT HOSE CONNECTION DIAGRAM**
4. **Connector**
5. **Cap**
   - Check with coolant system tester V.A.G1274 and adapter V.A.G 1274/9
   - Pressure relief valve must open at a pressure of 1.4 to 1.6 bar
6. **2.5 N.m**
7. **Expansion tank**
   - Perform leak test on coolant system with coolant system tester V.A.G 1274 and adapter V.A.G 1274/8
   - Test pressure: 1.4 to 1.6 bar
   - Observe markings. See **COOLANT, DRAINING AND FILLING** .
8. **To coolant pipe**
   - Coolant hose connection diagram. See **COOLANT HOSE CONNECTION DIAGRAM**
9. **Air ducting**
10. **5 N.m**
11. **Supplementary fan**
    - Only models with optional equipment
12. **Fan ring**
    - For additional fan
13. **Fan ring**
14. **Coolant fan**
15. **Bracket**
    - For coolant fan connector.
16. **Lower coolant hose**
    - Secured to radiator with retaining clip
    - Coolant hose connection diagram. See **COOLANT HOSE CONNECTION DIAGRAM** .
17. **O-ring**
    - Always replace
18. **Coolant Fan Control (FC) Thermal Switch -F18-, 35 N.m**
    - For electric fan
    - Switching temperatures:
      1. Speed

on: 92...97 °C

off: 84...91 °C

2. Speed

on: 99...105 °C

off: 91...98 °C

19. **Bracket**
    - For bottom of radiator
    - Note installed position
20. **Bracket**
    - For top of radiator
    - Note installed position

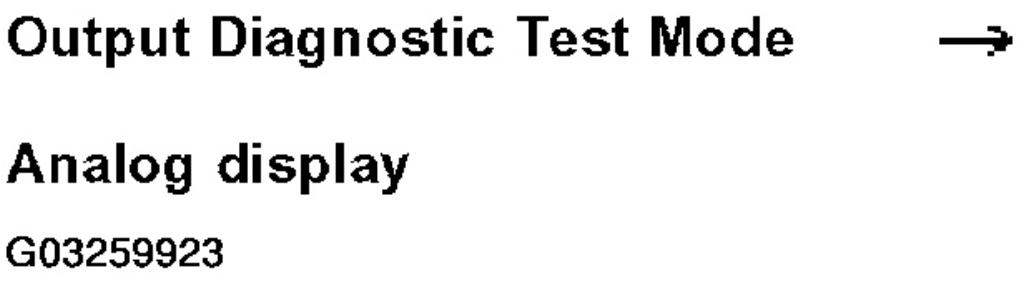


Fig. 1: Identifying Cooling System Components - Body Side
Courtesy of VOLKSWAGEN OF AMERICA, INC.

COOLING SYSTEM COMPONENTS - ENGINE SIDE

NOTE: The following list refers to items in Fig. 2 .

1. **15 N.m**
2. **Coolant pump**
    - Check for ease of movement
    - Note installed position
    - Removing and installing. See **COOLANT PUMP, REMOVING AND INSTALLING**
3. **O-ring**

- Always replace

4. **Bypass flap**
   - For exhaust gas recirculation radiator
5. **Radiator**
   - For exhaust gas recirculation
6. **To top of expansion tank**
   - Coolant hose connection diagram. See **COOLANT HOSE CONNECTION DIAGRAM**
7. **Upper front coolant pipe**
   - Installed with cylinder head cover on front side of cylinder head
   - One unit with fuel lines
8. **Connection union**
9. **Seal**
   - Check for secure seating
   - Always replace
10. **Securing clip**
    - Check for secure seating
11. **Engine Coolant Temperature (ECT) Sensor -G62-**
    - With Engine Coolant Temperature (ECT) Sensor -G2-
12. **10 N.m**
13. **Heating flange**
    - For glow plugs
14. **Glow plugs**
    - 25 N.m
    - Checking. See **GLOW PLUGS, CHECKING** .
15. **Quick-action coupling**
16. **To heat exchanger**
    - Coolant hose connection diagram. See **COOLANT HOSE CONNECTION DIAGRAM**
17. **From heat exchanger**
    - Coolant hose connection diagram. See **COOLANT HOSE CONNECTION DIAGRAM**
18. **Distributor**
19. **To top of radiator**
    - Coolant hose connection diagram. See **COOLANT HOSE CONNECTION DIAGRAM**
20. **Coolant pipe**
21. **40 N.m**
22. **To bottom of expansion tank**
    - Coolant hose connection diagram. See **COOLANT HOSE CONNECTION DIAGRAM**
23. **Transmission oil cooler**

24. **To bottom of radiator**
    - Coolant hose connection diagram. See **COOLANT HOSE CONNECTION DIAGRAM**
25. **Oil cooler**
    - Removing and installing. See **PART 2: DISASSEMBLING OIL FILTER BRACKET** .
26. **Connection union**
    - For thermostat
27. **Thermostat**
    - Removing and installing. See **THERMOSTAT, REMOVING AND INSTALLING** .
    - Observe installed position. See **THERMOSTAT, REMOVING AND INSTALLING** .
    - Checking: Heat-up thermostat in water
    - Starts to open: approx. 85° C
    - Ends: approx. 105° C
    - Opening stroke: min. 7 mm

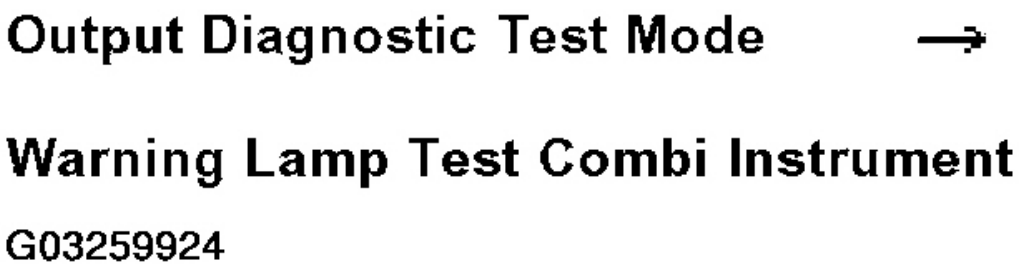


Fig. 2: Identifying Cooling System Components - Engine Side
Courtesy of VOLKSWAGEN OF AMERICA, INC.

COOLANT HOSE CONNECTION DIAGRAM

NOTE: The following list refers to items in Fig. 3 .

1. **Radiator**
2. **Oil cooler**
3. **Thermostat**
4. **Coolant pump**
5. **Cylinder block**
6. **Expansion tank**

7. **Intake manifold**
8. **Radiator**
    - For exhaust gas recirculation
9. **Bypass flap**
    - For exhaust gas recirculation radiator
10. **Connection union**
    - To cylinder block
11. **Heater unit heat exchanger**
12. **Quick-action coupling**
13. **Coolant pipe**
14. **Transmission oil cooler**
15. **Distributor**
16. **Upper front coolant pipe**

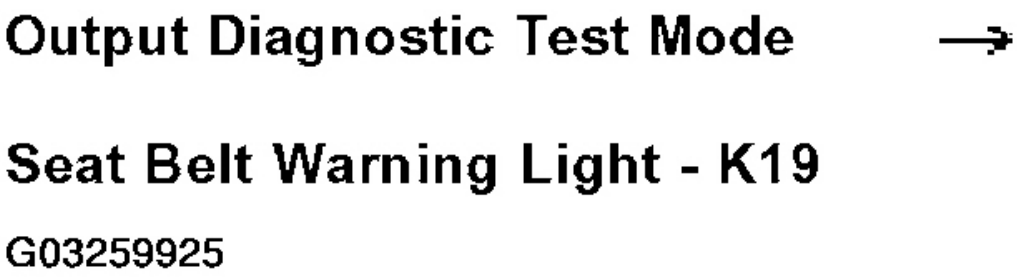


Fig. 3: Coolant Hose Connection Diagram
Courtesy of VOLKSWAGEN OF AMERICA, INC.

COOLANT, DRAINING AND FILLING

Special tools and equipment

- T10007 Refractometer
- V.A.G 1306 Drip tray for VAG1202A
- VAS 5024 Assembly tool for spring-type clips

Not illustrated:

- VAS 6096 Coolant system charging unit

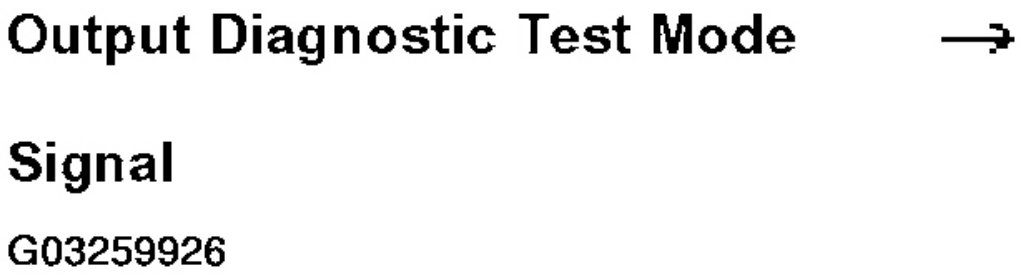


Fig. 4: Identifying Special Tools And Equipment
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Draining

WARNING: Steam can be released when the cap is removed from the expansion tank. Cover cap with a cloth and open carefully.

- Remove cap from coolant expansion tank.
- Remove center and left side sound insulation:

  See **NOISE INSULATION, ASSEMBLY OVERVIEW** .

- Remove drain plug (arrow) from radiator to drain.

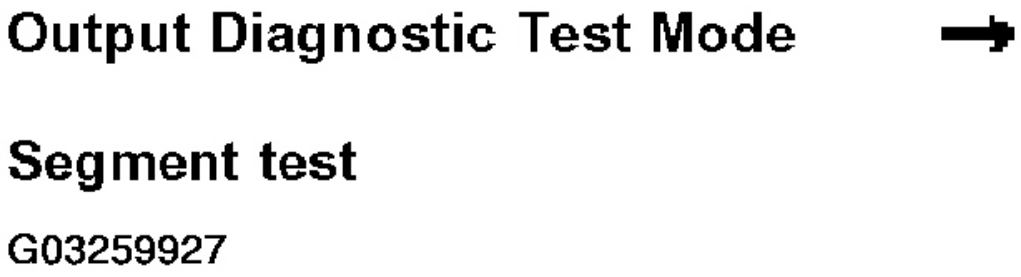


Fig. 5: Removing Drain Plug From Radiator To Drain
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- To drain coolant from engine, remove forward coolant hose from oil cooler (arrow).

NOTE: Observe disposal regulations!

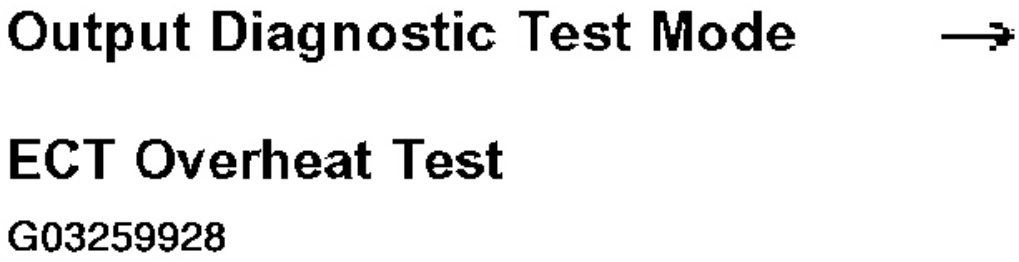


Fig. 6: Removing Forward Coolant Hose From Oil Cooler
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Filling

- Only use coolant additive G12 in accordance with TL VW 774 F. Distinguishing features: lilac (purple) color
- G12 lilac (according to TL VW 774 F) can be mixed with coolant additive G12 red.
- G12 and coolant additives marked "In accordance with TL VW 774 F" prevent frost and corrosion damage, scaling and raise the boiling point of coolant. For this reason the system must be filled all year round with frost and corrosion protection additives.
- Because of its high boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.
- Protection against frost must be assured to about -25 °C (in arctic climatic countries to about -35 °C).
- The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The anti-freeze ratio must be at least 40%.
- If for climatic reasons a higher frost protection is required, the amount of G12 can be increased, but only up to 60% (frost protection to about -40 °C), otherwise frost protection is reduced again and cooling effectiveness is also reduced.
- Refractometer T10007 is recommended to determine coolant freezing temperature.

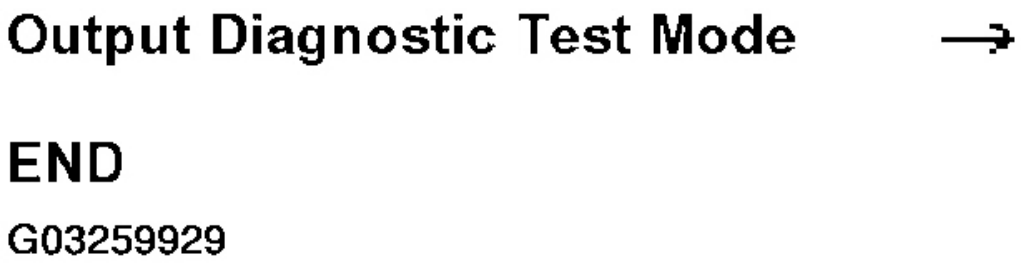


Fig. 7: Identifying Special Tool (Refractometer T10007)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- If radiator, heat exchanger, cylinder head or cylinder head gasket is replaced, do not reuse old coolant.

Recommended mixture proportions:

RECOMMENDED COOLANT MIXTURE PROPORTIONS

Anti-freeze to	Anti-freeze proportion	G12(1)	Water(1) , (2)
-25 °C	40%	2.4 liter	3.6 liter
-35 °C	50%	3.0 liter	3.0 liter
(1) The quantity of coolant can vary in dependence on the vehicle equipment.			
(2) Use only clean drinking water.			

- Screw drain plug into radiator.
- Push coolant hose onto oil cooler connection and secure with a spring-type clamp.

With charging unit VAS 6096

- Fill coolant system using coolant system charging unit VAS 6096.

  Refer to instruction manual for coolant system charging unit VAS 6096

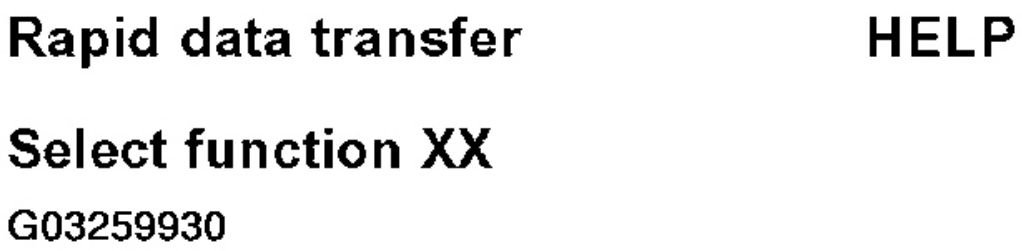


Fig. 8: Pushing Coolant Hose Onto Oil Cooler Connection
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Without charging unit VAS 6096

- Fill coolant slowly up to upper hatched field mark (arrow) on expansion tank.

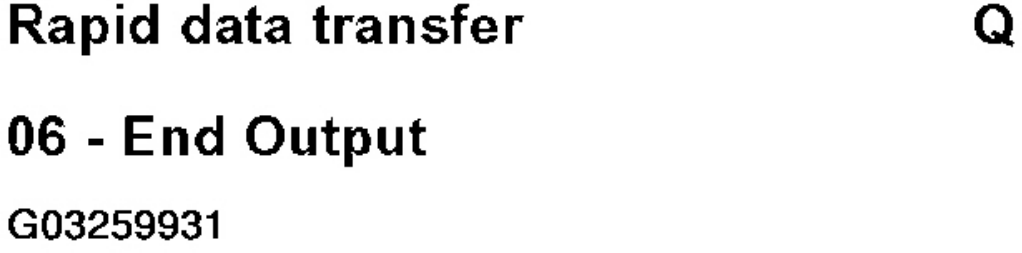


Fig. 9: Filling Coolant Up To Upper Hatched Field Mark On Expansion Tank
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Close expansion tank.
- Run engine until coolant fan cuts-in.
- Check coolant level and replenish if necessary.

  When engine is at normal operating temperature coolant level must lie on upper marking of hatched field (arrow).

  When engine is cold coolant level must lie approx. in middle of hatched field.

RADIATOR, REMOVING AND INSTALLING

Special tools and equipment

- T10007 Refractometer
- V.A.G 1306 Drip tray for VAG1202A
- V.A.G 1331 Torque wrench (5 to 50 N.m)
- VAS 5024 Assembly tool for spring-type clips

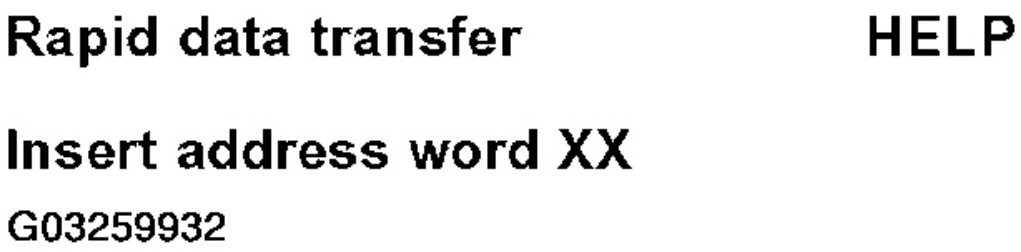


Fig. 10: Identifying Special Tools And Equipment (Radiator)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Removing

- Drain coolant. See **COOLANT, DRAINING AND FILLING** .
- Remove front end:

  See **FRONT END, ASSEMBLY OVERVIEW** .

- Remove coolant hoses from radiator.
- Remove connectors from thermal switch and coolant fan.
- Remove lock carrier:

  See **LOCK CARRIER, ASSEMBLY OVERVIEW**

- Remove radiator securing bolts and take out radiator.

NOTE: Models with air conditioning system:

- **Observe additional information and removal work. See ADDITIONAL INFORMATION AND ASSEMBLY WORK ON MODELS WITH AN A/C**

SYSTEM .

Installing

Installation is performed in reverse order. Note the following:

- Fill with coolant. See **COOLANT, DRAINING AND FILLING** .

Additional information and assembly work on models with an A/C system

CAUTION: The air conditioning system refrigerant circuit must not be opened.

NOTE: To prevent damage to the condenser as well as to the refrigerant lines, ensure that lines and hoses are not stretched, kinked or bent.

- Release refrigerant lines/hoses from retainers/clamps if necessary.
- Secure radiator to body before removing lock carrier.
- To remove radiator, secure condenser to body.

COOLANT PUMP, REMOVING AND INSTALLING

Special tools and equipment

- T10007 Refractometer
- V.A.G 1306 Drip tray for VAG1202A
- V.A.G 1331 Torque wrench (5 to 50 N.m)
- VAS 5024 Assembly tool for spring-type clips

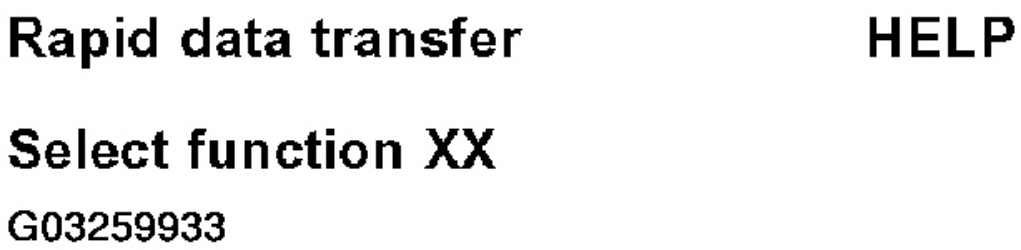


Fig. 11: Special Tools And Equipment (Coolant Pump)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Removing

NOTE: Always replace seals and gaskets.

- Drain coolant. See **COOLANT, DRAINING AND FILLING** .
- Remove toothed (timing) belt. See **TOOTHED BELT, REMOVING AND INSTALLING** .
- Remove coolant pump securing bolts -1- and remove coolant pump -2- carefully.

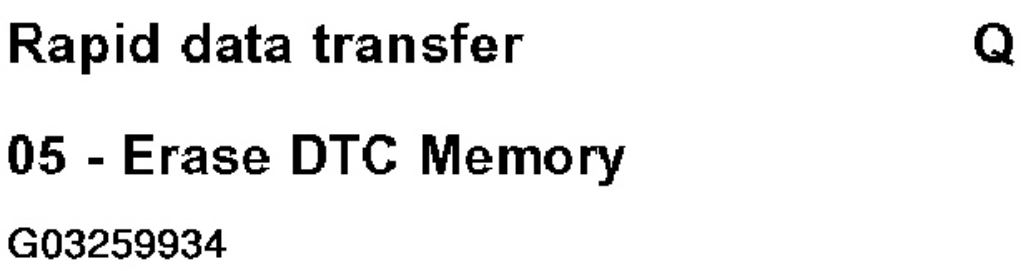


Fig. 12: Removing Coolant Pump And Securing Bolts
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Installing

Installation is performed in reverse order. Note the following:

- Clean or smooth sealing surface for O-ring.
- Moisten new O-ring -3- with coolant.
- Insert coolant pump -2- into cylinder block and tighten securing bolts -1-.

  Tightening torque: 15 N.m

  NOTE: The coolant pump plug faces downward.

- Install toothed (timing) belt. See **TOOTHED BELT, REMOVING AND INSTALLING** .
- Fill with coolant. See **COOLANT, DRAINING AND FILLING** .

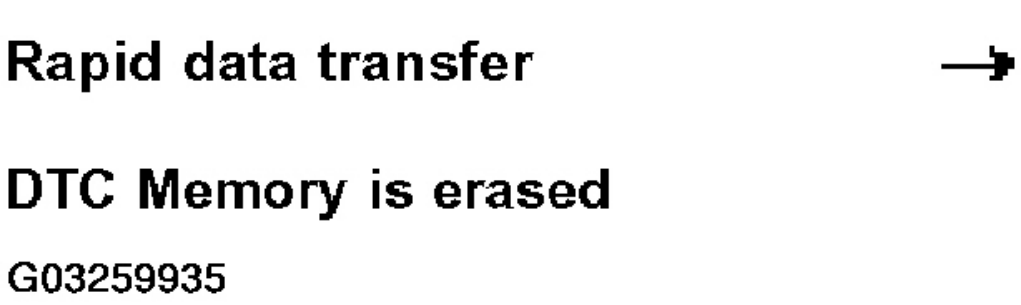


Fig. 13: Identifying Coolant Pump And Components
Courtesy of VOLKSWAGEN OF AMERICA, INC.

THERMOSTAT, REMOVING AND INSTALLING

Special tools and equipment

- T10007 Refractometer
- V.A.G 1306 Drip tray
- V.A.G 1331 Torque wrench (5 to 50 N.m)
- VAS 5024 Assembly tool for spring-type clips

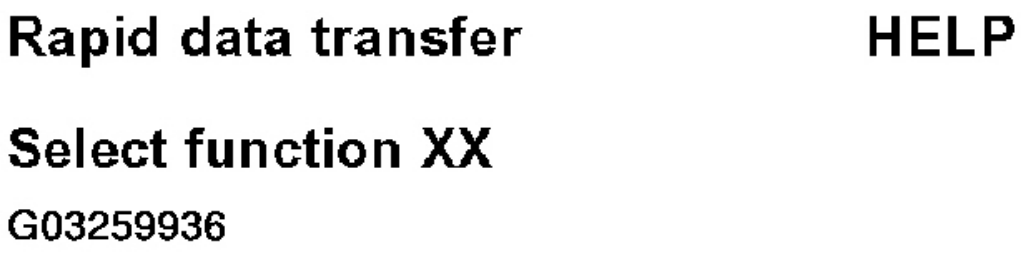


Fig. 14: Identifying Special Tools And Equipment
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Removing

NOTE:

- **Always replace seals and gaskets.**

- Drain coolant. See **COOLANT, DRAINING AND FILLING** .
- Remove coolant hose from pipe union.
- Remove securing bolts -1- of pipe union -2- and remove pipe union -2- with thermostat -4-.
- Turn thermostat -4- 1/4 turn (90°) to left and remove from pipe union -2-.

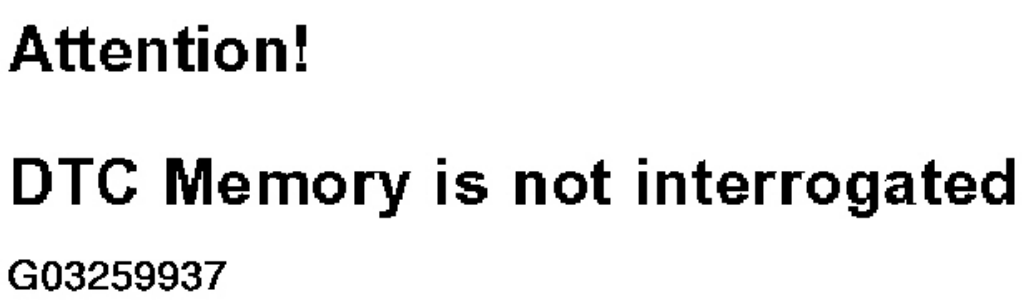


Fig. 15: Removing Pipe Union With Thermostat
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Installing

Installation is performed in reverse order. Note the following:

- Coat new O-ring -3- with coolant and install to pipe union -2-.
- Insert thermostat -4- into pipe union -2- and turn 1/4 (90°) to right.

NOTE: The brace on the thermostat must be almost vertical.

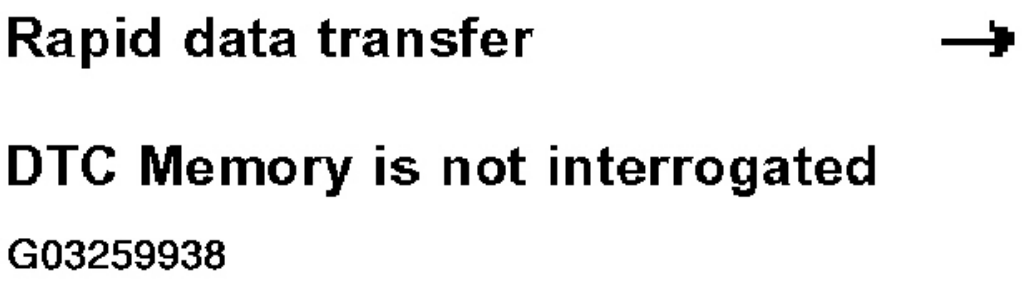


Fig. 16: Installing Connecting Union With Thermostat
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Install connecting union -2- with thermostat -4- into engine block.
- Tighten securing bolts -1-.

  Tightening torque: 15 N.m

- Fill with coolant. See **COOLANT, DRAINING AND FILLING** .

GLOW PLUGS, CHECKING

Special tools and equipment

- V.A.G 1594 A Adapter set

Fig. 17: Identifying Special Tools And Equipment (V.A.G 1594 Adapter Set)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- V.A.G 1527 B Diode test lamp

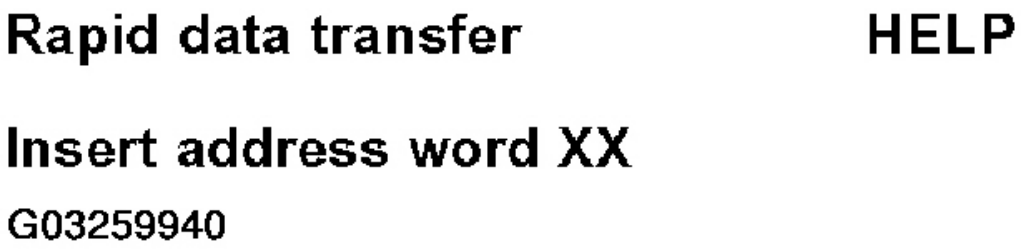


Fig. 18: Identifying Special Tools And Equipment (V.A.G 1527 B Diode Test Lamp)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Requirements

- Battery voltage at least 11.5 V
- Ignition switched off

Work sequence

Checking electric activation of glow plugs:

- Disconnect connector -1- from glow plugs.
- Connect diode test lamp cable with clamps from adapter set to battery positive (+).
- Insert diode test lamp test pick to every glow plug one after another.

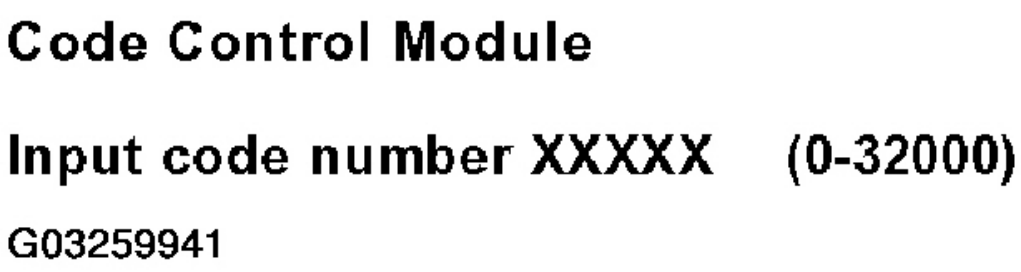


Fig. 19: Using Diode Test Lamp To Check Glow Plug
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Diode lights up: glow plug is OK

Diode does not light up:

- Replace glow plug. See **GLOW PLUGS, CHECKING** .

COOLING SYSTEM, SERVICING

COOLING SYSTEM, GENERAL INFORMATION

WARNING: **When performing repair work, especially due to the confined conditions in the engine compartment, pay attention to the following:**

- **Route all types of lines (e.g. for fuel, hydraulics, EVAP system, coolant, refrigerant, brake fluid and vacuum) as well as electrical wiring so that the original positions are restored.**
- **Ensure sufficient clearance to all moving or hot components.**

NOTE:

- **When the engine is warm the cooling system is under pressure. If necessary release the pressure before beginning repair work.**
- **Hoses are secured with spring-type clamps. In cases of repair only use spring-type clamps.**
- **Assembly tool VAS 5024 or hose clip pliers V.A.G 1921 are recommended for installing spring-type clamps.**

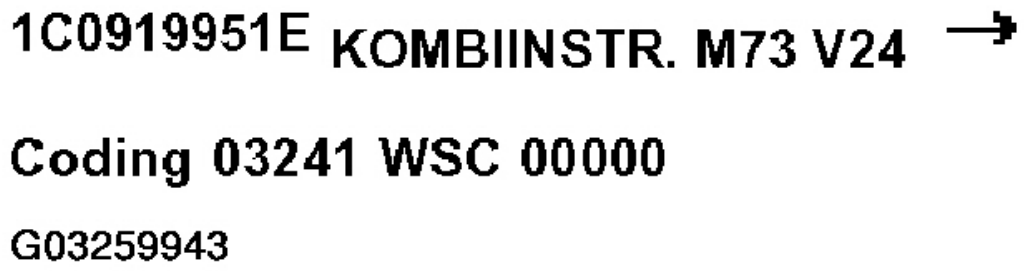


Fig. 1: Identifying Special Tools
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- **When installing coolant hoses route stress-free so that they do not come into contact with other components (observe markings on coolant connection and hose).**

Perform cooling system leakage test with cooling system tester V.A.G 1274 and adapters V.A.G 1274/8 and

V.A.G 1274/9.

Components of cooling system body side, See **COOLING SYSTEM COMPONENTS - BODY SIDE, REMOVING AND INSTALLING** .

Components of cooling system engine side, See **COOLING SYSTEM COMPONENTS - ENGINE SIDE, REMOVING AND INSTALLING** .

Coolant hose connection diagram, See **COOLANT HOSE CONNECTION DIAGRAM**

Draining and filling with coolant, See **COOLING SYSTEM, DRAINING AND FILLING** .

Coolant mixing ratios, See **COOLING SYSTEM, DRAINING AND FILLING**

COOLING SYSTEM COMPONENTS - BODY SIDE, REMOVING AND INSTALLING

NOTE: Coolant hose connection diagram, See COOLANT HOSE CONNECTION DIAGRAM

NOTE: The following list refers to items in Fig. 2 .

1. **Radiator**
   - Removing and installing, See **RADIATOR, REMOVING AND INSTALLING**
   - After replacement replace entire coolant amount
2. **O-ring**
   - Replace
3. **Upper coolant hose**
   - Secured to radiator with retaining clip
   - Coolant hose connection diagram, See **COOLANT HOSE CONNECTION DIAGRAM**
4. **4 N.m**
5. **Cover**
   - Check with cooling system tester V.A.G1274 and adapter V.A.G 1274/9
   - Pressure relief valve must open at a pressure of 1.4...1.6 bar
6. **2 N.m**
7. **Expansion tank**
   - Perform leak test on cooling system with cooling system tester V.A.G 1274 and adapter V.A.G1274/8
   - Test pressure 1.4...1.6 bar
   - Observe markings, See **COOLING SYSTEM, DRAINING AND FILLING**
8. **Connector**
9. **To coolant pipe**

- Coolant hose connection diagram, See **COOLANT HOSE CONNECTION DIAGRAM**

10. **Air ducting**
11. **10 N.m**
12. **Right coolant fan -V35-**
    - Only models with optional equipment
    - Checking, See **COOLANT FAN, CHECKING**
    - Removing and installing, See **RADIATOR, REMOVING AND INSTALLING**
13. **Fan ring**
    - For right coolant fan
14. **Retaining clip**
    - Check if seated securely
15. **Fan ring**
16. **Coolant fan - V7-**
    - Checking, See **COOLANT FAN, CHECKING**
    - Removing and installing, See **RADIATOR, REMOVING AND INSTALLING**
17. **Retainer**
    - For coolant fan connector
18. **Lower coolant hose**
    - Secured to radiator with retaining clip
    - Coolant hose connection diagram, See **COOLANT HOSE CONNECTION DIAGRAM**
    - Check if seated securely
19. **Coolant Fan Control (FC) thermal switch -F18-, 35 N.m**
    - For electric fan
    - Switching temperatures: 1. stage on: 92...97°C, off: 84...91°C; 2. stage on: 99...105 C, off: 91...98° C
20. **Retainer**
    - For bottom of radiator
21. **Retainer**
    - For top of radiator
    - Observe installed position

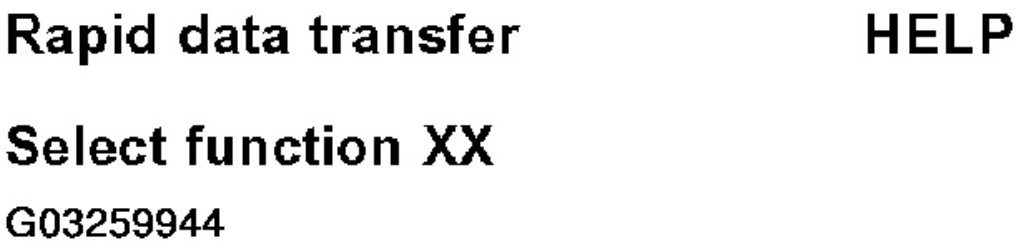


Fig. 2: Exploded View Of Body Side Cooling System Components
Courtesy of VOLKSWAGEN OF AMERICA, INC.

COOLING SYSTEM COMPONENTS -ENGINE SIDE, REMOVING AND INSTALLING

NOTE: **Coolant hose connection diagram, See COOLANT HOSE CONNECTION DIAGRAM**

NOTE: **The following list refers to items in Fig. 3 .**

1. **Heating system heat exchanger**
2. **Connector**
   - 4-pin
   - Gold plated contacts for ECT sensor - G62-
3. **Engine Coolant Temperature (ECT) sensor -G62-**
   - For engine control module
   - With ECT sensor -G2-
   - Gold plated contacts for ECT sensor -G62-
   - Release pressure in cooling system if necessary before removing components
4. **Connector**
   - 2-pin
   - Only for engine code AEG until Model Year 1999
   - Only vehicles with air conditioner with 4-pin A/C Pressure Switch -F129-
5. **A/C cut-out thermal switch -F163-**
   - Only for engine code AEG until Model Year 1999
   - Only vehicles with air conditioner with 4-pin A/C Pressure Switch -F129-
   - Vehicles with air conditioner only, otherwise blind plug
6. **Coolant pipe**

- Coolant hose connection diagram, See **COOLANT HOSE CONNECTION DIAGRAM**

7. **Retaining clip**
   - Check if seated securely
8. **10 N.m**
9. **To bottom of expansion tank**
   - Coolant hose connection diagram, See **COOLANT HOSE CONNECTION DIAGRAM**
10. **To top of radiator**
    - Coolant hose connection diagram, See **COOLANT HOSE CONNECTION DIAGRAM**
11. **O-ring**
    - Replace
12. **Connecting unions**
13. **To bottom of radiator**
    - Coolant hose connection diagram, See **COOLANT HOSE CONNECTION DIAGRAM**
14. **Oil cooler**
    - Removing and installing, See **PART II (OIL FILTER HOUSING, DISASSEMBLING AND ASSEMBLING)** .
15. **15 N.m**
16. **Coolant thermostat**
    - Checking: Heat up thermostat in water
    - Starts to open: approx. 86°C
    - Opening stroke: min. 7 mm
    - Removing and installing, See **THERMOSTAT, REMOVING AND INSTALLING**
17. **Toothed belt**
    - Mark direction of rotation before removing
    - Check for wear
    - Do not kink
    - Removing, installing and tensioning. See **TOOTHED BELTS, REMOVING, INSTALLING AND TENSIONING** .
18. **Coolant pump**
    - Check for ease of movement
    - If damaged or leaking replace complete
    - Removing and installing, See **COOLANT PUMP, REMOVING AND INSTALLING**
19. **Rear toothed belt guard**
20. **20 N.m**
21. **Throttle valve control module**
    - Heated by coolant
    - Coolant hose connection diagram, See **COOLANT HOSE CONNECTION DIAGRAM**
22. **To top of expansion tank**

- Coolant hose connection diagram, See **COOLANT HOSE CONNECTION DIAGRAM**

23. **O-ring**
    - Replace if damaged

Fig. 3: Exploded View Of Engine Side Cooling System Components
Courtesy of VOLKSWAGEN OF AMERICA, INC.

COOLANT HOSE CONNECTION DIAGRAM

Engine code AEG (up to Model Year 1998)

NOTE: Engine codes AEG (from Model Year 1999), AVH, AZG, BDC, BEV, BGD, see ENGINE CODES AEG (FROM MODEL YEAR 1999), AVH, AZG, BDC, BEV, BGD .

NOTE: The following list refers to items in Fig. 4 .

1. **Radiator**
2. **Oil cooler**
3. **Coolant pump/coolant thermostat**
4. **Cylinder head/cylinder block**
5. **Expansion tank**
6. **Intake manifold**
7. **Throttle valve control module**
8. **Union**
9. **Heating system heat exchanger**
10. **Coolant pipe**
11. **ATF cooler**
    - Only models with an automatic transmission

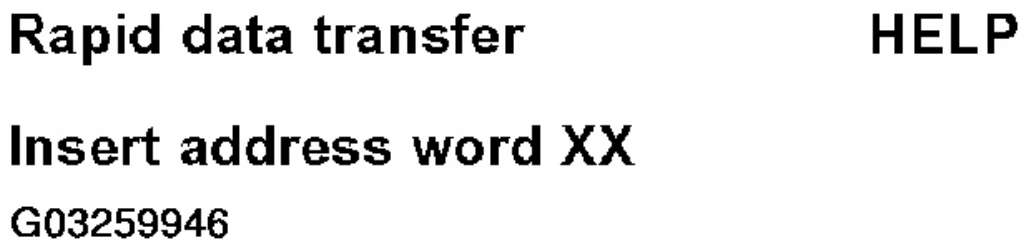


Fig. 4: Coolant Hose Connection Diagram (Engine Code AEG Up To Model Year 1998)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Engine codes AEG (from Model Year 1999), AVH, AZG, BDC, BEV, BGD

NOTE: The following list refers to items in Fig. 5 .

1. **Radiator**
2. **Oil cooler**
3. **Coolant pump/coolant thermostat**
4. **Cylinder head/cylinder block**
5. **Expansion tank**
6. **Intake manifold**
7. **Throttle valve control module**
8. **Connecting unions**
9. **Heating system heat exchanger**
10. **Quick-action coupling**
11. **Coolant pipe**
12. **ATF cooler**
    - Only models with an automatic transmission

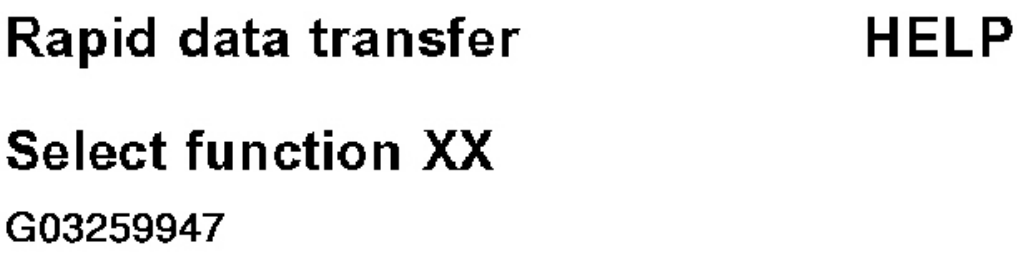


Fig. 5: Coolant Hose Connection Diagram (Engine Codes AEG From Model Year 1999, AVH, AZG, BDC, BEV, BGD)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

COOLING SYSTEM, DRAINING AND FILLING

Special tools, equipment, testers, measuring instruments and auxiliary items required

- T10007 Refractometer
- V.A.G 1306 Drip tray
- Torque wrench VAG 1331
- VAS 5024 Assembly tool for spring-type clamps
- Adapter for expansion tank VAG 1274/8
- VAS 6096 Coolant system charging unit

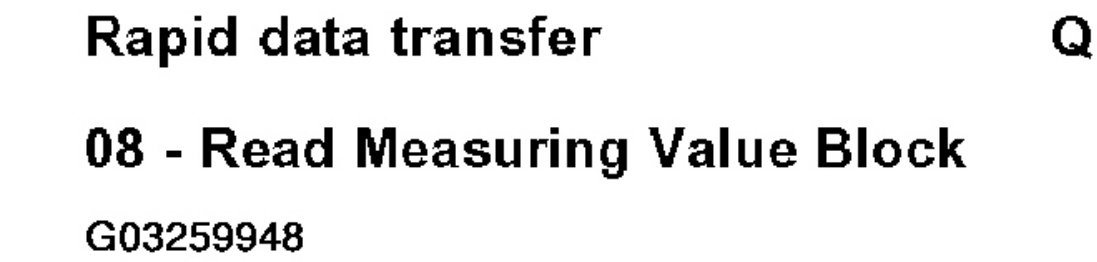


Fig. 6: Identifying Special Tools
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Draining

WARNING: Steam can be released when removing the cap from the expansion tank. Cover the cap with a cloth and open carefully.

- Open cap on coolant expansion tank.
- Remove sound insulation tray:

  See **NOISE INSULATION, ASSEMBLY OVERVIEW** .

- Place drip tray VAG 1306 under vehicle.
- Remove drain plug (arrow) to drain coolant from radiator.

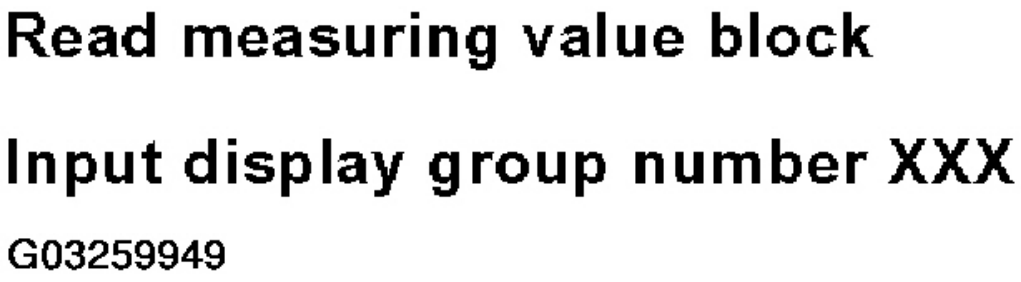


Fig. 7: Removing Radiator Drain Plug
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Remove coolant hose from oil cooler (arrow) to drain coolant from engine.

NOTE: Observe waste disposal regulations!

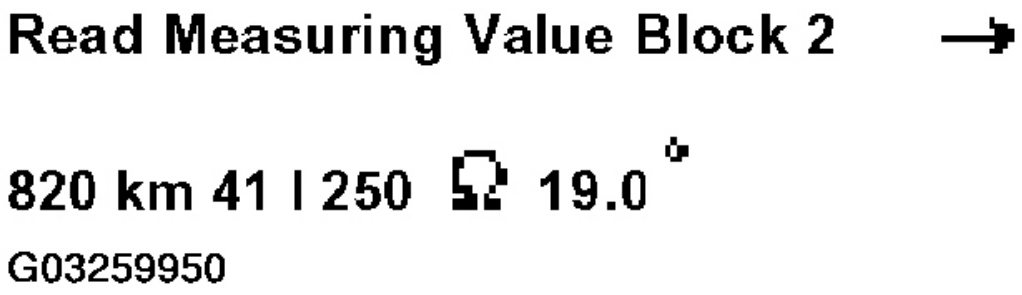


Fig. 8: Removing Coolant Hose From Oil Cooler
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Filling

NOTE:

- **Only use coolant additive G 12 in accordance with TL VW 774 F. Distinguishing color: violet**
- **G 12 and coolant additives marked "In accordance with TL VW 774 F" prevent frost and corrosion damage, scaling and also raise boiling point of coolant. For this reason the system must be filled all year round with frost and corrosion protection additives.**
- **G 12 (according to TL VW 774 F) can be mixed with coolant additive G12 which is colored red.**
- **Because of its high boiling point, the coolant improves engine reliability under heavy loads, particularly in countries with tropical climates.**
- **Protection against frost must be assured to about -25° C (in arctic climatic countries to about -35° C).**
- **The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The anti-freeze ratio must be at least 40%.**
- **If for climatic reasons a higher anti-freeze is required, the amount of G 12 can be increased, but only up to 60% (anti-freeze to about -40° C), as otherwise antifreeze is reduced again and cooling effectiveness is also reduced.**
- **Refractometer T 10007 is recommended to determine coolant freezing temperature.**

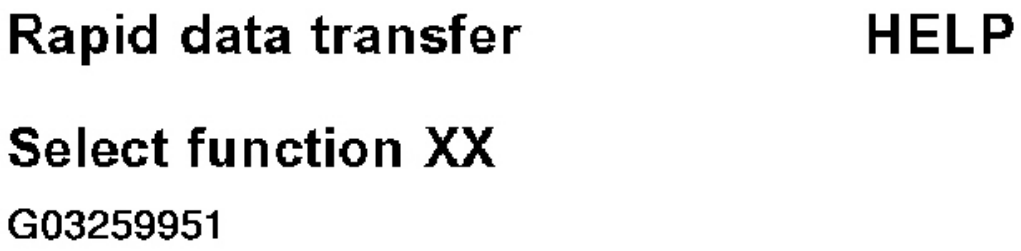


Fig. 9: Identifying Refractometer T 10007
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- **If radiator, heat exchanger, cylinder head or cylinder head gasket is replaced, do not reuse old coolant.**

Recommended mixture ratios:

RECOMMENDED MIXTURE RATIOS SPECIFICATIONS

Antifreeze to	Anti-freeze proportion	G 12(1)	(1) , (2) Water
-25° C -	40%	2.0 I	3.0 I
-35° C	50%	2.5 I	2.5 I
(1) The quantity of coolant can vary in depending on the level of vehicle equipment.			
(2) Use only clean drinking water.			

Work sequence

- Screw drain plug into radiator.
- Push coolant hose onto oil cooler connection and secure with a spring-type clamp.

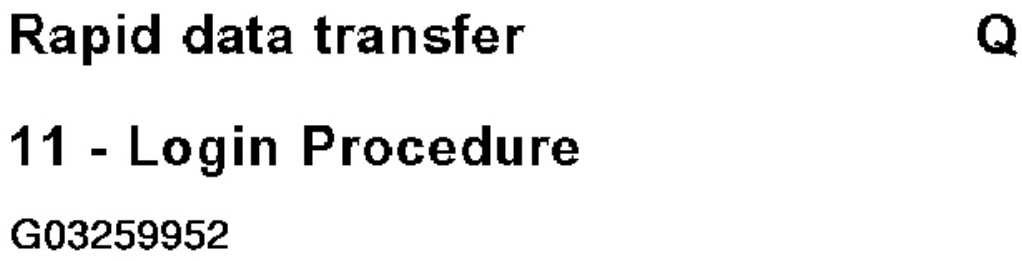


Fig. 10: Pushing Coolant Hose Onto Oil Cooler Connection And Securing With Spring-Type Clamp
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Vehicles with max. expansion tank marking

- Fill with coolant up to max. mark on expansion tank.

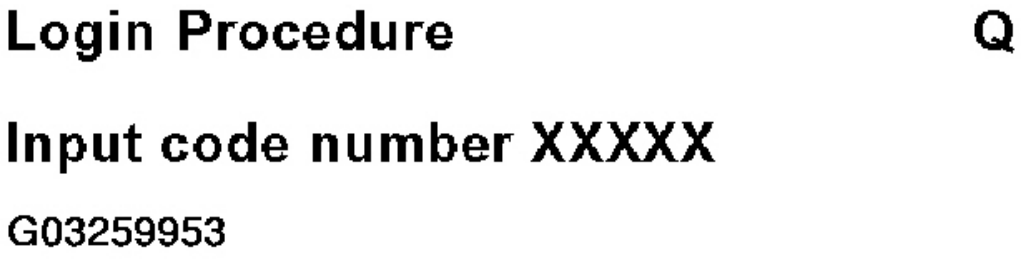


Fig. 11: Identifying Expansion Tank (Vehicles With Max. Tank Marking)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Fit expansion tank cap.
- Switch off heater and air conditioner.
- Start engine and maintain an engine speed of about 2000 RPM for approx. 3 minutes.
- Run engine until coolant fan starts.
- Switch off ignition.

WARNING: Steam can be released when removing the cap from the expansion tank. Cover the cap with a cloth and open carefully.

- Check coolant level and top up if necessary.

  When engine is at normal operating temperature, coolant level must be on max. mark.

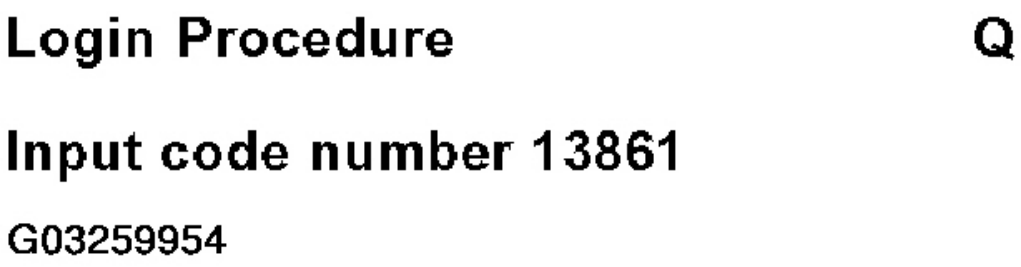


Fig. 12: Identifying Expansion Tank (Vehicles With Max. Tank Marking)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

When engine is cold coolant level must be between min. and max. marks.

Vehicles without max. expansion tank marking

- Fill coolant slowly up to upper hatched field mark (arrow) on expansion tank.

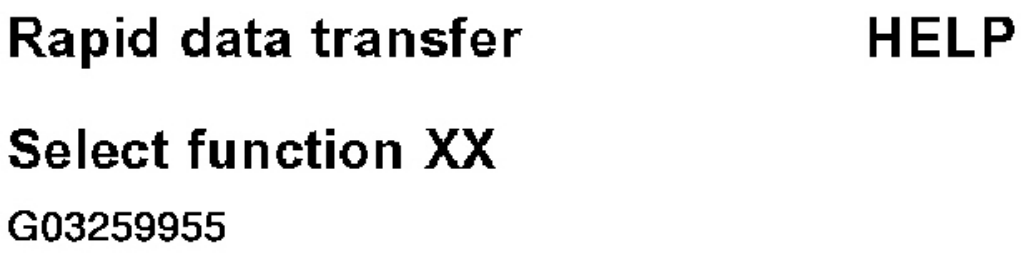


Fig. 13: Identifying Expansion Tank (Vehicles Without Max. Tank Marking)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Close expansion tank.
- Switch off heater and air conditioner.
- Start engine and maintain an engine speed of about 2000 RPM for approx. 3 minutes.

- Run engine until coolant fan starts.
- Switch off ignition.

WARNING: Steam can be released when removing the cap from the expansion tank. Cover the cap with a cloth and open carefully.

- Check coolant level and top up if necessary:

  Coolant level must be at upper hatched field mark when engine is at operating temperature (arrow).

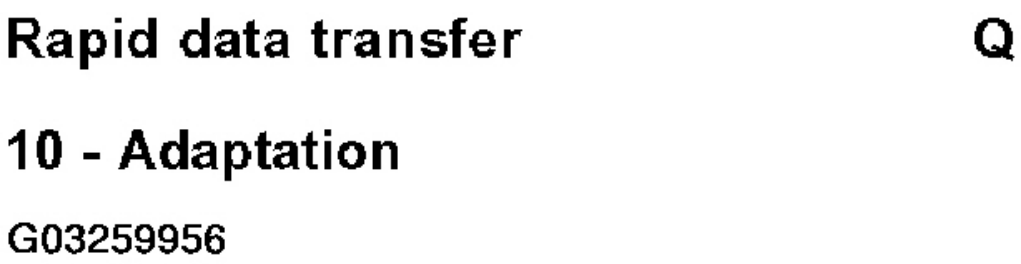


Fig. 14: Identifying Expansion Tank (Vehicles Without Max. Tank Marking)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

When engine is cold coolant level should be around middle of hatched field.

Filling coolant system with charging unit VAS 6096

- Screw adapter V.A.G1274/8 onto expansion tank.
- Fill coolant system using coolant system charging unit VAS 6096:

  See Instruction manual for coolant system charging unit VAS 6096

RADIATOR, REMOVING AND INSTALLING

Special tools, equipment, testers, measuring instruments and auxiliary items required

- T10007 Refractometer
- V.A.G 1306 Drip tray
- V.A.G 1331 Torque wrench (5...50 N.m)
- VAS 5024 Assembly tool for spring-type clamps

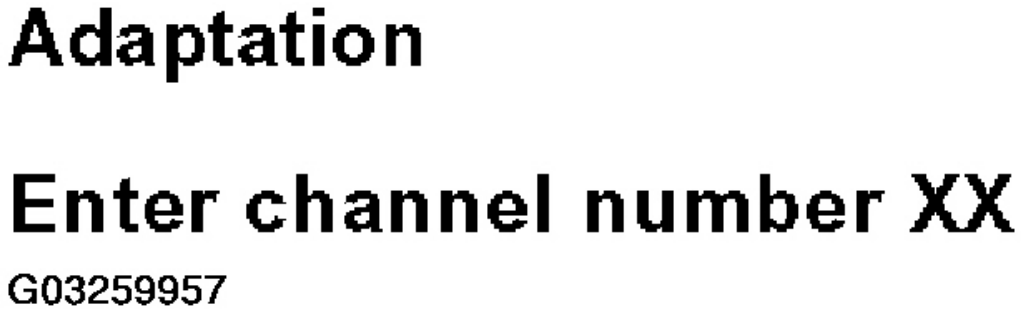


Fig. 15: Identifying Special Tools
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Removing

- Drain coolant, See **COOLING SYSTEM, DRAINING AND FILLING**
- Pull connectors off thermal switch -1- and coolant fan -2-.
- Remove front end:

  See **FRONT END, ASSEMBLY OVERVIEW** .

- Remove lock carrier:

  See **LOCK CARRIER, ASSEMBLY OVERVIEW** .

- Pull coolant hoses quick release couplings off radiator.

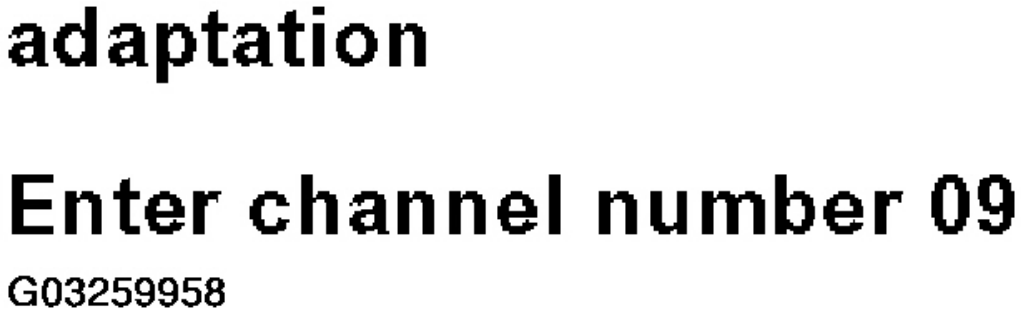


Fig. 16: Disconnecting Thermal Switch And Coolant Fan Connectors
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Models with air conditioning

- Observe additional information and removal work, See **Additional information and assembly work on models with an air conditioning system** .

Continuation for all models

- Remove radiator securing bolts and take out radiator.

Installing

Install in reverse sequence. Note the following points:

- Check electrical connections and routing:

  See appropriate SYSTEM WIRING DIAGRAMS article

- Refill with coolant, See **COOLING SYSTEM, DRAINING AND FILLING** .

Additional information and assembly work on models with an air conditioning system

CAUTION: The air conditioning refrigerant circuit must not be opened.

NOTE: To prevent damage to the condenser as well as to the refrigerant lines/hoses, ensure that the lines and hoses are not stretched, kinked or bent.

- Remove retaining clamp(s) from refrigerant lines.
- Secure radiator to body before removing lock carrier.
- Remove condenser from radiator and secure to lock carrier.

COOLANT FAN, CHECKING

Engine codes AEG, AVH, AZG

Special tools, equipment, testers, measuring instruments and auxiliary items required

- V.A.G 1594 Adapter set
- Wiring diagram

Fig. 17: Identifying Special Tool
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Requirements

- Main fuses must be OK
- Coolant Fan Control (FC) thermal switch -F18- OK

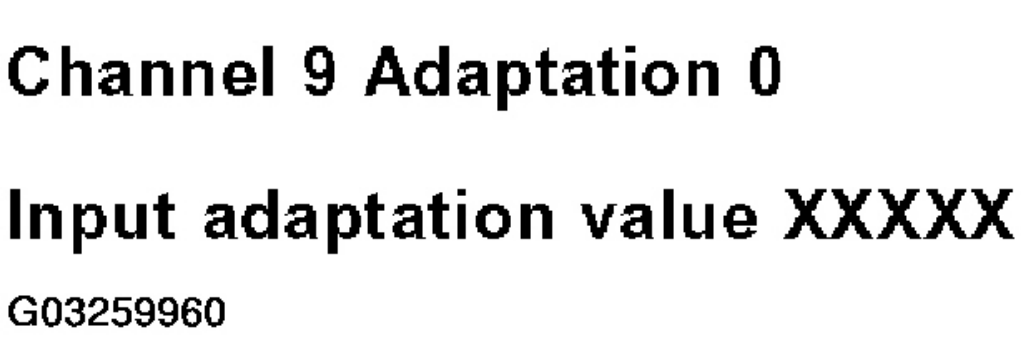


Fig. 18: Locating Main Fuses (Left Front Corner Of Engine Compartment)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Work sequence

- Remove left side sound insulation:

  See **NOISE INSULATION, ASSEMBLY OVERVIEW** .

- Disconnect 3-pin connector from Coolant Fan Control (FC) thermal switch -F18-.
- Bridge contact -1- and contact -2- of connector with auxiliary cables from V.A.G 1594 A.

Connector type A

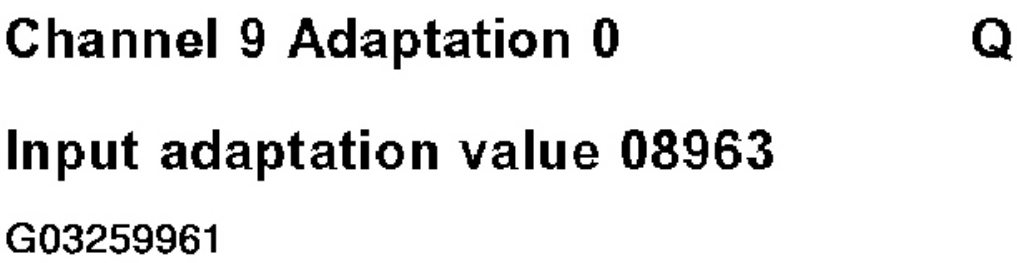


Fig. 19: Identifying Coolant Fan Connector Type A
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Connector type B

Fig. 20: Identifying Coolant Fan Connector Type B
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Connector type C

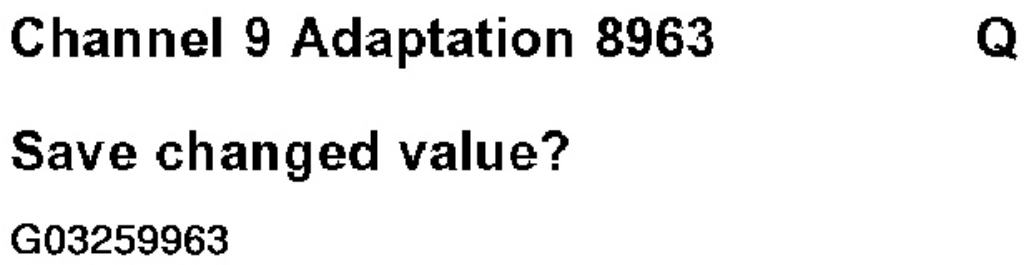


Fig. 21: Identifying Coolant Fan Connector Type C
Courtesy of VOLKSWAGEN OF AMERICA, INC.

1st speed for Coolant fan -V7- and Right coolant fan -V35- must start

- Switch on ignition.
- Bridge contact -2- and contact -3- of connector with auxiliary cables from V.A.G 1594 A.

  2nd speed for Coolant fan -V7- and Right coolant fan -V35- must start.

If 1st or 2nd speeds of fans do not run:

- Locate and eliminate open circuit using wiring diagram:

See appropriate SYSTEM WIRING DIAGRAMS article.

If no wiring fault is detected:

- Replace Coolant fan -V7- or Right coolant fan -V35-.

COOLANT PUMP, REMOVING AND INSTALLING

Special tools, equipment, testers, measuring instruments and auxiliary items required

- T10007 Refractometer
- V.A.G 1306 Drip tray
- V.A.G 1331 Torque wrench (5...50 N.m)
- VAS 5024 Assembly tool for spring-type clamps

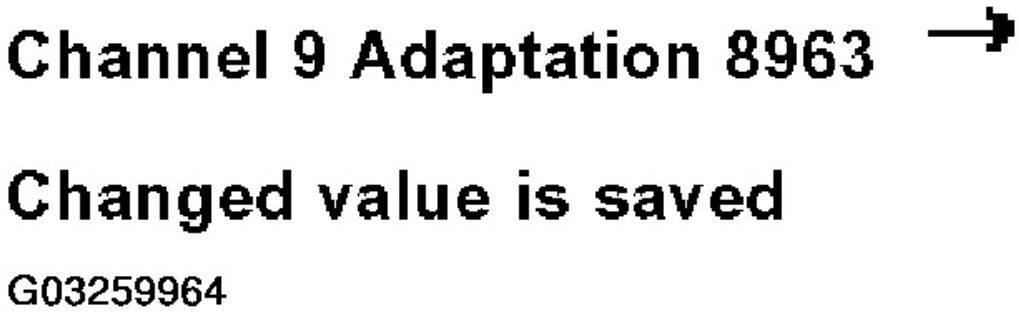


Fig. 22: Identifying Special Tools
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Removing

NOTE:

- **Always replace seals and gaskets.**
- **The lower section of the toothed belt guard need not be removed.**
- **The toothed belt should be left in position on the crankshaft pulley.**
- **Cover the toothed belt with a cloth to protect it from coolant before removing the coolant pump.**

- Drain coolant, See **COOLING SYSTEM, DRAINING AND FILLING** .
- Remove ribbed belt, See **RIBBED BELT, REMOVING AND INSTALLING** .
- Remove tensioning element for ribbed belt.

- Remove upper and center sections of toothed belt guard.
- Take toothed (timing) belt off coolant pump toothed belt pulley. See **TOOTHED BELTS, REMOVING, INSTALLING AND TENSIONING** .
- Unscrew securing bolt -1- for rear toothed belt guard -2-. See **Fig. 23** .
- Unscrew securing bolts -5- for coolant pump and remove coolant pump -4-.

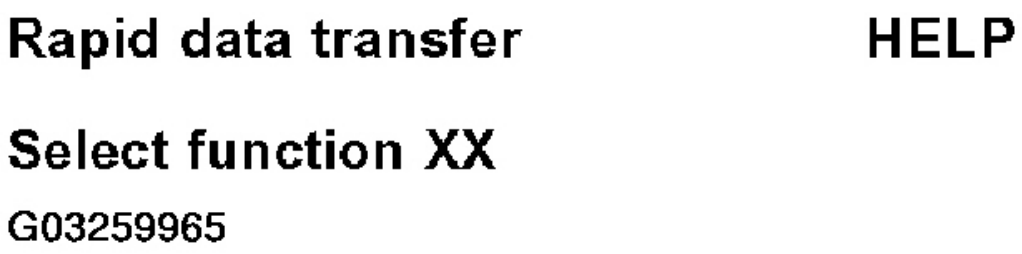


Fig. 23: Removing Coolant Pump
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Installing

Installation is performed in the reverse sequence. Note the following:

- Moisten new O-ring -3- with coolant. See **Fig. 24** .
- Install coolant pump -4-. Installation position: Coolant pump sealing plug faces downward.
- Tighten securing bolts -5- to 15 N.m.
- Tighten securing bolt -1- for rear toothed belt guard -2- on cylinder head to 20 N.m

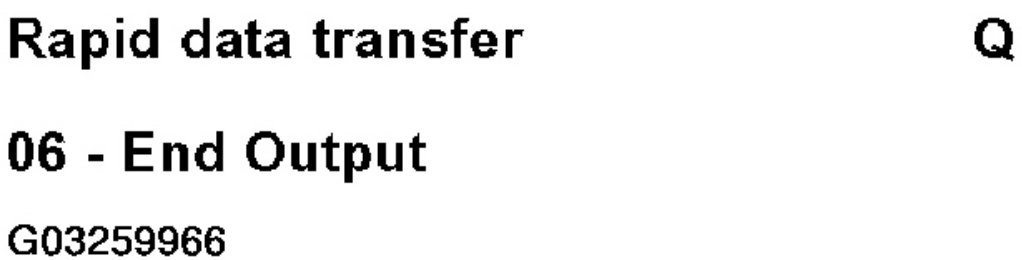


Fig. 24: Installing Coolant Pump
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Installing toothed belt and adjusting timing. See **TOOTHED BELTS, REMOVING, INSTALLING AND TENSIONING** .

- Install ribbed belt tensioning element and torque to 25 N.m.
- Install ribbed belt. See **RIBBED BELT, REMOVING AND INSTALLING** .
- Fill with coolant, See **COOLING SYSTEM, DRAINING AND FILLING** .

THERMOSTAT, REMOVING AND INSTALLING

Special tools, equipment, testers, measuring instruments and auxiliary items required

- T10007 Refractometer
- V.A.G 1306 Drip tray
- V.A.G 1331 Torque wrench (5-50 N.m)
- VAS 5024 Assembly tool for spring-type clamps

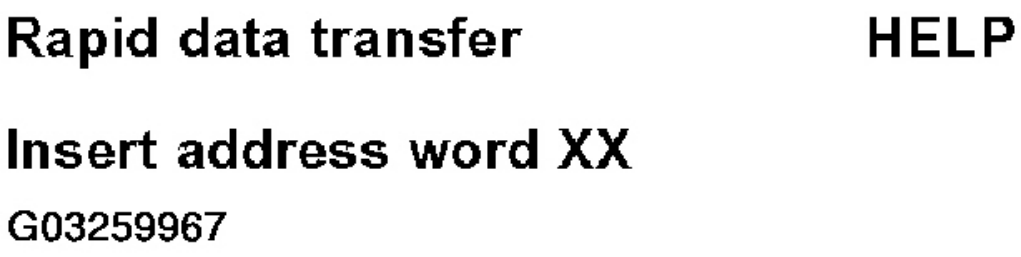


Fig. 25: Identifying Special Tools
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Removing

NOTE: Always replace seals and gaskets.

- Drain coolant, See **COOLING SYSTEM, DRAINING AND FILLING** .
- Pull coolant hose off union -3-. See **Fig. 26** .
- Remove securing bolts -4- of union -3- and remove union -3- with thermostat -1-.

Rapid data transfer Q

17 - Instrument Cluster

G03259968

Fig. 26: Removing And Installing Thermostat
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Installing

Installation is performed in the reverse sequence. Note the following:

- Moisten new O-ring -2- with coolant. See **Fig. 26** .
- Fit union -3- with thermostat -1- onto engine block.

NOTE: The brace on the thermostat must be almost vertical.

- Tighten securing bolts -4- to 15 N.m.
- Fill with coolant, See **COOLING SYSTEM, DRAINING AND FILLING** .

COOLING SYSTEM COMPONENTS, REMOVING AND INSTALLING

GENERAL INFORMATION

NOTE:

- **As the engine warms up, cooling system pressure also increases. If necessary, release pressure before starting repair work.**
- **Hoses are secured with spring clips. When performing repairs, only use spring clips.**
- **VAG 1921 pliers are recommended for installing spring clips.**
- **When installing coolant hoses, route them stress-free, so they do not come into contact with other components (observe markings on coolant connections and hoses).**

Perform cooling system leakage test with VAG 1274 cooling system tester and 1274/9 adapter.

Cooling system components, body side. See **COOLING SYSTEM COMPONENTS, BODY SIDE** .

Cooling system components, engine side. See **COOLING SYSTEM COMPONENTS, ENGINE SIDE** .

Coolant hose connections, diagram. See **COOLANT HOSE CONNECTIONS, DIAGRAM** .

Engine coolant, draining and filling. See **COOLING SYSTEM, DRAINING AND FILLING** .

Engine coolant, mixture ratios. See **RADIATOR, REMOVING AND INSTALLING** .

COOLING SYSTEM COMPONENTS, BODY SIDE

NOTE: The following list refers to items in Fig. 1 .

1. **Radiator**
   - Removing and installing. See **RADIATOR, REMOVING AND INSTALLING**
   - After replacing, replace entire engine coolant
2. **O-ring**
   - Always replace
3. **Coolant hose, upper**
   - Attached to radiator with clip
   - Coolant hose connections, diagram. See **COOLANT HOSE CONNECTIONS, DIAGRAM**
4. **Retaining clip**

- Make sure it is securely seated

5. **Engine Coolant Temperature (ECT) sensor -G62-**
   - Checking:

     See On Board Diagnostic (OBD)

   - With Engine Coolant Temperature (ECT) sensor -G2-
6. **4 N.m (35 in. lb)**
7. **Cap**
   - Check using VAG1274 tester and VAG 1274/8 adapter
   - Test pressure 1.4 to 1.6 bar
8. **2 N.m (18 in. lb)**
9. **Coolant expansion tank**
   - Perform cooling system leak check using VAG 1274 tester with VAG 1274/9 adapter
10. **Connector**
11. **To cylinder head**
    - Coolant hose connections, diagram. See **COOLANT HOSE CONNECTIONS, DIAGRAM** .
12. **Air ducting**
13. **10 N.m (7 ft lb)**
14. **Additional fan**
    - Optional equipment
15. **Fan ring**
    - For auxiliary fan
16. **Retaining clip**
    - Make sure it is seated securely
17. **Fan ring**
18. **Coolant fan**
19. **Bracket**
    - For coolant fan connector
20. **Coolant hose, lower**
    - Attached to radiator with clip
    - Coolant hose connection diagram. See **COOLANT HOSE CONNECTIONS, DIAGRAM** .
21. **Coolant fan control (FC) thermal switch -F18-**
    - 35 N.m (26 ft lb)
    - For electric fan

    Switching temperatures:

    - Stage 1 ON: 92 to 97° C OFF: 84 to 91° C

- Stage 2 ON: 99 to 105° C OFF: 91 to 98° C

22. **Bracket**
    - For radiator
23. **Bracket**
    - For radiator
    - Note installation position

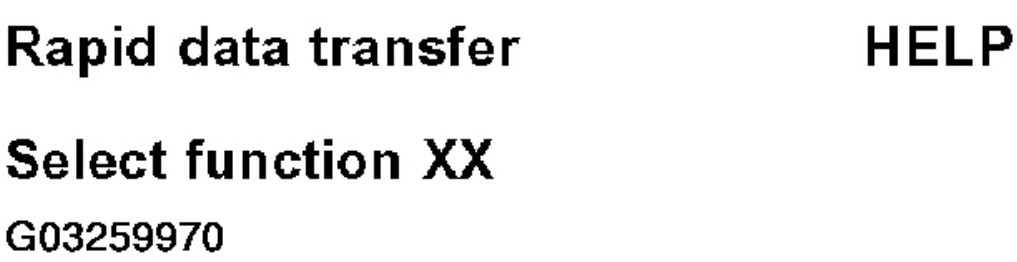


Fig. 1: Exploded View Of Cooling System Components (Body Side)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

COOLING SYSTEM COMPONENTS, ENGINE SIDE

NOTE: The following list refers to items in Fig. 2 .

1. **25 N.m (18 ft lb)**
2. **Coolant pump**
    - Check arm for ease of movement
    - Note installation position
    - Removing and installing: See **COOLANT PUMP, REMOVING AND INSTALLING** .
    - If damaged and leaking replace complete assembly
3. **O-ring**
    - Always replace
4. **EGR cooler**
5. **To expansion tank**
    - Coolant hose connection diagram. See **COOLANT HOSE CONNECTIONS, DIAGRAM** .
6. **Coolant hose, upper**
    - Coolant hose connections, diagram. See **COOLANT HOSE CONNECTIONS, DIAGRAM** .
7. **To cylinder head**

- Coolant hose connections, diagram. See **COOLANT HOSE CONNECTIONS, DIAGRAM** .

8. **To heat exchanger**
   - Coolant hose connections, diagram. See **COOLANT HOSE CONNECTIONS, DIAGRAM** .
9. **From heat exchanger**
   - Coolant hose connections, diagram. See **COOLANT HOSE CONNECTIONS, DIAGRAM** .
10. **Coolant pipe**
    - Coolant hose connections, diagram. See **COOLANT HOSE CONNECTIONS, DIAGRAM** .
11. **10 N.m (7 ft lb)**
12. **To expansion tank, lower**
    - Coolant hose connections, diagram. See **COOLANT HOSE CONNECTIONS, DIAGRAM** .
13. **EGR cooler supply**
    - Coolant hose connections, diagram. See **COOLANT HOSE CONNECTIONS, DIAGRAM** .
14. **Connection**
    - With glow plugs -Q7- for auxiliary heater
15. **To top of radiator**
    - Coolant hose connections, diagram. See **COOLANT HOSE CONNECTIONS, DIAGRAM** .
    - Clipped to bulkhead
16. **O-ring**
    - Make sure it is seated securely
    - Always replace
17. **To bottom of radiator**
    - Coolant hose connections, diagram. See **COOLANT HOSE CONNECTIONS, DIAGRAM** .
18. **Connection**
    - For thermostat
19. **Coolant thermostat**
    - Removing and installing. See **THERMOSTAT, REMOVING AND INSTALLING** .
    - Observe installed position. See **THERMOSTAT, REMOVING AND INSTALLING** .
    - Checking: heat-up thermostat in water
    - Opening starts at 85° C approx.
    - Ends approx. 105° C
    - Opening lift 7 mm minimum
20. **Oil cooler**
    - Removing and installing: See **PART II** (item -3-)

Fig. 2: Exploded View Of Cooling System (Engine Side)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

COOLANT HOSE CONNECTIONS, DIAGRAM

NOTE: The following list refers to items in Fig. 3 .

1. **Radiator**
2. **Oil cooler**
3. **Coolant pump**
4. **Engine block**
5. **Expansion tank**
6. **Intake manifold**
7. **EGR cooler**
8. **Heating system heat exchanger**
9. **Coolant pipe**
10. **Transmission cooler**
    - Vehicles with automatic transmission
11. **Coolant hose, upper**
12. **Coolant hose, lower**

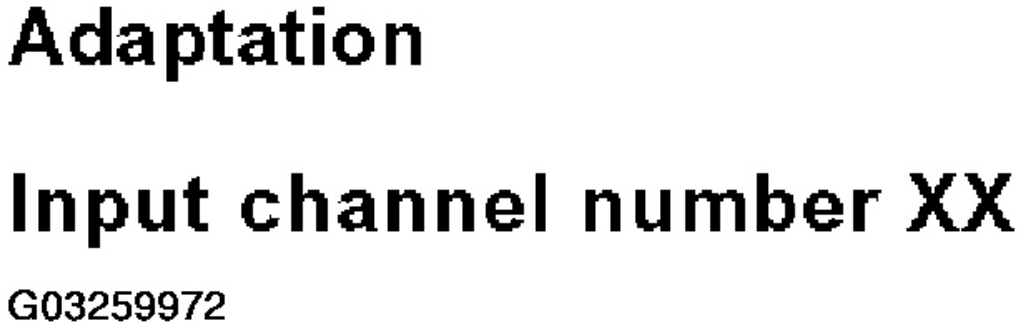


Fig. 3: Identifying Coolant Hose Connections (Coolant Flow Diagram)
Courtesy of VOLKSWAGEN OF AMERICA, INC.

COOLING SYSTEM, DRAINING AND FILLING

Special tools and equipment

- VAG 1306 Drip tray for VAG1202A

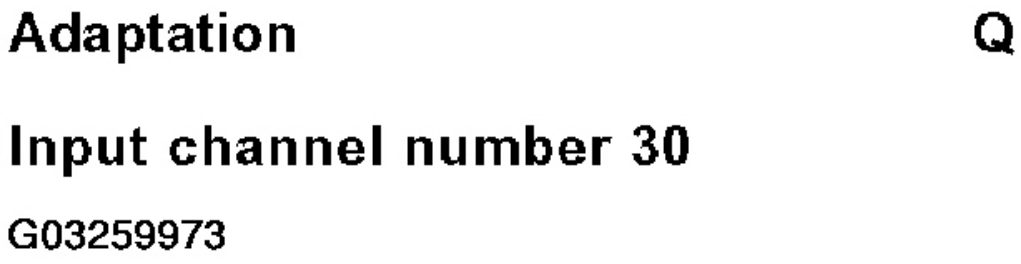


Fig. 4: Identifying Vag 1306 Drip Tray For Vag1202A
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- VAG 1921 Hose clip pliers
- Anti-freeze tester

Fig. 5: Identifying VAG 1921 Hose Clip Pliers
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Draining

- Remove engine cover.
- Remove cap from coolant expansion tank.
- Remove insulation tray center and left:

  See **PLENUM CHAMBER SEALING ASSEMBLY, REMOVING AND INSTALLING** .

- Unscrew drain plug to drain coolant from radiator (arrow).

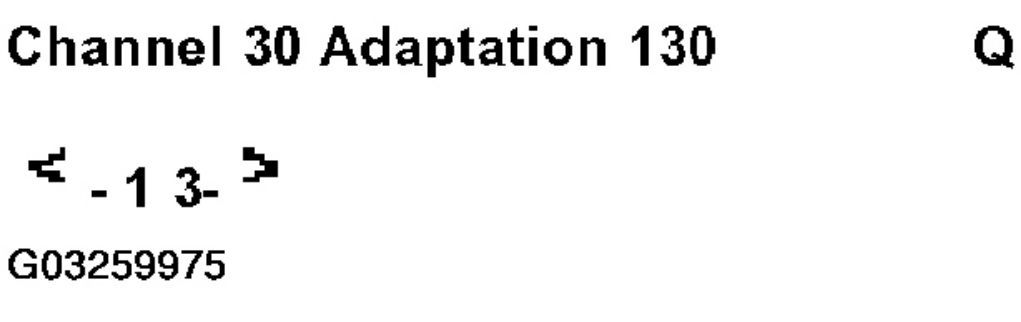


Fig. 6: Locating Radiator Drain Plug
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- To drain coolant from engine also remove coolant hose from oil cooler (arrow).

NOTE: **Observe proper disposal regulations!**

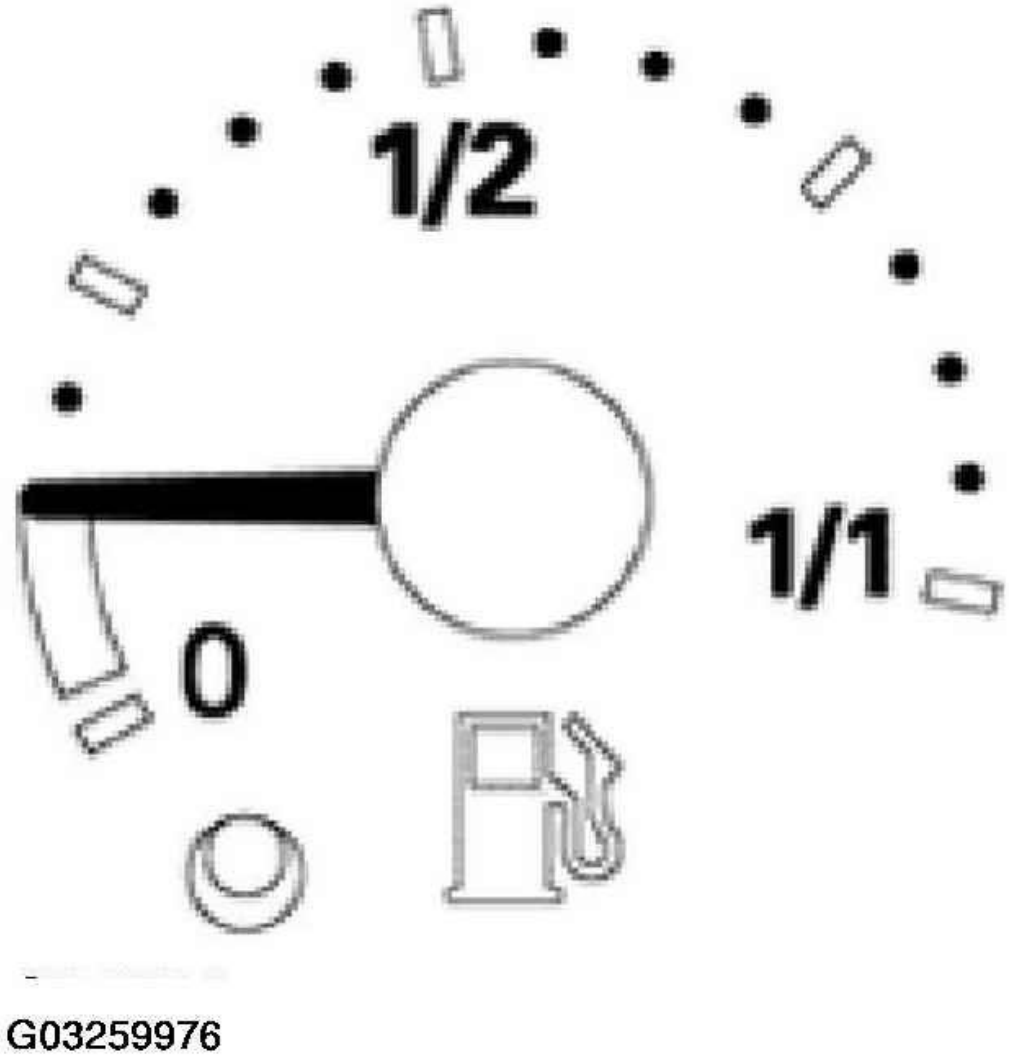


Fig. 7: Removing Coolant Hose From Oil Cooler
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Filling

NOTE:

- **Only use coolant additive G 12 in accordance with TL VW 774 D. Identification: red colored.**
- **On no account must G 12 be mixed with other coolant additives!**

- **If the fluid in expansion tank is brown, G 12 has been mixed with other coolant. In this case the coolant must be changed.**
- **G 12 and coolant additives marked "In accordance with TL VW 774 D" prevent frost and corrosion damage, scaling and also raise boiling point of coolant. For this reason the system must be filled all year round with frost and corrosion protection additives.**
- **Particularly in countries with tropical climates, the coolant due to the higher boiling point improves engine reliability when heavily loaded.**
- **Protected against frost to about -25° C (in arctic climatic countries to about -35° C).**
- **The coolant concentration must not be reduced by adding water even in warmer seasons and in warmer countries. The anti-freeze ratio must be at least 40%.**
- **Use clean drinking water when mixing the coolant.**
- **If for climatic reasons a greater frost protection is required, the amount of G 12 can be increased, but only up to 60% (frost protection to about -40° C), as otherwise frost protection is reduced again and cooling effectiveness is also reduced.**
- **If radiator, heat exchanger, cylinder head or cylinder head gasket is replaced, do not reuse old coolant.**

RECOMMENDED COOLANT MIXTURE RATIOS

Frost protection to:	Antifreeze amount	G 12 (1)	Water (1)
-25° C	40%	2.4 ltr.	3.6 ltr.
-35° C	50%	3.0 ltr.	3.0 ltr.
(1) The quantity of coolant can vary depending upon the vehicle equipment.			

- Close drain plug for coolant.
- Fill with coolant up to MAX. mark on expansion tank.

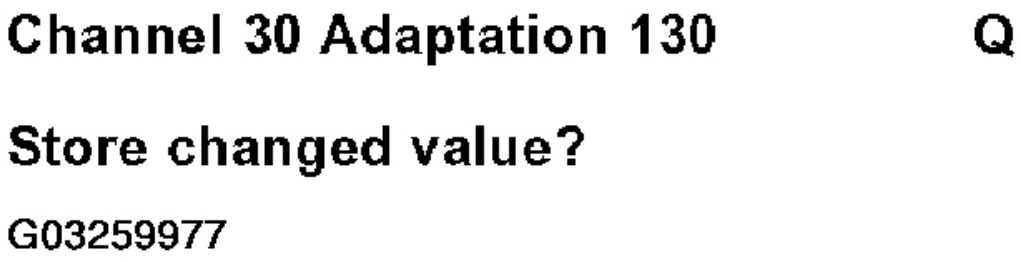


Fig. 8: Identifying Coolant Level Mark
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Install coolant expansion tank cap.
- Run engine until radiator fan comes on.
- Check coolant level and top off if necessary.

When engine is at normal operating temperature, coolant level must be on MAX. mark

When engine is cold, coolant level can be between MIN. and MAX. marks.

RADIATOR, REMOVING AND INSTALLING

Special tools and equipment

- VAG 1306 Drip tray forVAG1202A
- VAG 1331 Torque wrench: 5 to 50 N.m (3.7 to 37 ft lb)
- VAG 1921 Hose clip pliers
- Anti-freeze tester

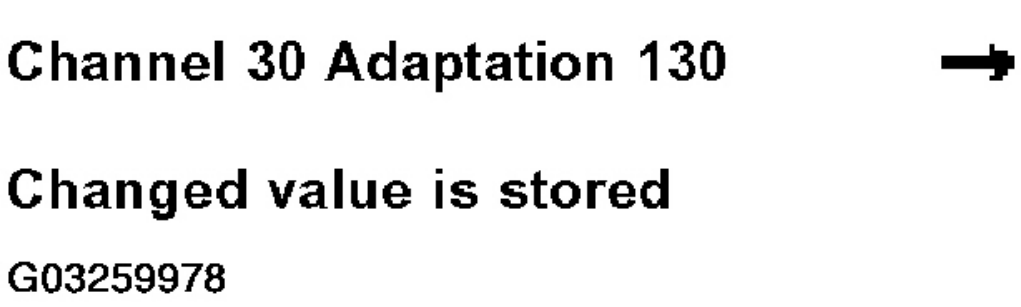


Fig. 9: Identifying Special Tools And Equipment
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Removing

- Drain coolant. See **COOLING SYSTEM, DRAINING AND FILLING** .
- Remove front panel:

  See **PLENUM CHAMBER SEALING ASSEMBLY, REMOVING AND INSTALLING** .

- Disconnect coolant hoses from radiator.
- Disconnect connectors from thermo-switch.
- Remove ribbed belt tensioner. See **RIBBED BELT TENSIONER, REMOVING AND INSTALLING** .
- Remove radiator mounting bolts and take out radiator.

NOTE: Vehicles with A/C:

- **Observe additional information and removal work. See A/C SYSTEM, ADDITIONAL REMOVAL INFORMATION .**

Installing

Installation is carried out in the reverse order of the removal procedure. Note the following during installation:

Engine coolant, filling. See **COOLING SYSTEM, DRAINING AND FILLING** .

A/C SYSTEM, ADDITIONAL REMOVAL INFORMATION

WARNING: Do NOT open the A/C refrigerant circuit.

NOTE: **To prevent damage to the condenser and to the refrigerant lines/hoses, make sure that the lines and hoses are not stretched, kinked or bent.**

- Remove retaining clamp(s) from refrigerant lines.
- Before removing lock support, fasten radiator to body
- To remove radiator, fasten condenser to the body.

COOLANT PUMP, REMOVING AND INSTALLING

Special tools and equipment

- VAG 1306 Drip tray forVAG1202A
- VAG 1331 Torque wrench: 5 to 50 N.m (3.7 to 37 ft lb)
- VAG 1921 Hose clip pliers
- Anti-freeze tester

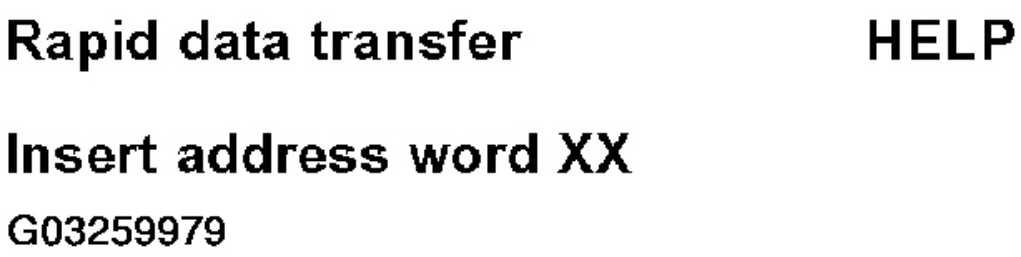


Fig. 10: Identifying Special Tools And Equipment
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Removing

NOTE:

- **Always replace seals and gaskets.**
- **Lower part of the toothed belt guard need not be removed.**
- **Toothed belt should be left in position on the crankshaft sprocket.**
- **Cover toothed belt with a cloth to protect it from coolant before removing coolant pump.**

- Drain coolant. See **COOLING SYSTEM, DRAINING AND FILLING** .
- Remove ribbed belt. See **RIBBED BELT TENSIONER, REMOVING AND INSTALLING** .
- Disconnect fuel supply and return lines at fuel filter.

- Remove connector hose between charge air cooler and intake manifold. See **CHARGE AIR COOLER COMPONENTS, REMOVING AND INSTALLING** .
- Remove fuel filter with bracket. See **FUEL FILTER, SERVICING** .
- Remove belt guard upper and middle sections. See **PART II** .
- Remove V-belt from camshaft sprocket, injection pump sprocket and coolant pump sprocket. See **TOOTHED BELTS, REMOVING, INSTALLING, TENSIONING** .
- Unscrew mounting bolt -1- from pulley -2- and press downward approx. 30 mm.

Fig. 11: Removing Mounting Bolt From Pulley
Courtesy of VOLKSWAGEN OF AMERICA, INC.

- Unscrew mounting bolts -3- from coolant pump and carefully remove coolant pump -4- between engine bracket and toothed belt guard.

Installing

Installation is carried out in the reverse order of the removal procedure. Note the following during installation:

- Moisten new O-ring -3- with clean engine coolant.
- Insert coolant pump -4- into engine block and tighten mounting bolts -5- to 15 N.m (11 ft lb).

NOTE: Coolant pump plug points downward.

- Install pulley -2- and tighten mounting bolt -1- (replace). Tightening torque: 40 N.m (30 ft lb) plus additional 90° (1/4 turn).
- Install and tighten toothed belt. See **TOOTHED BELTS, REMOVING, INSTALLING, TENSIONING** .
- Install fuel filter with bracket.
- Disconnect fuel supply and return lines at fuel filter.
- Install ribbed belt. See **RIBBED BELT TENSIONER, REMOVING AND INSTALLING** .

- Install connecting hose between charge air cooler and intake hose. See **CHARGE AIR COOLER COMPONENTS, REMOVING AND INSTALLING** .
- Fill engine with coolant. See **COOLING SYSTEM, DRAINING AND FILLING** .

THERMOSTAT, REMOVING AND INSTALLING

Special tools and equipment

- VAG 1306 Drip tray for VAG1202A
- VAG 1331 Torque wrench: 5 to 50 N.m (3.7 to 37 ft lb)
- VAG 1921 Hose clip pliers
- Anti-freeze tester

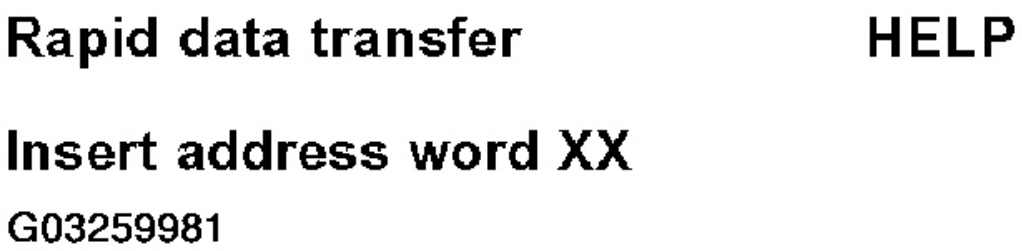
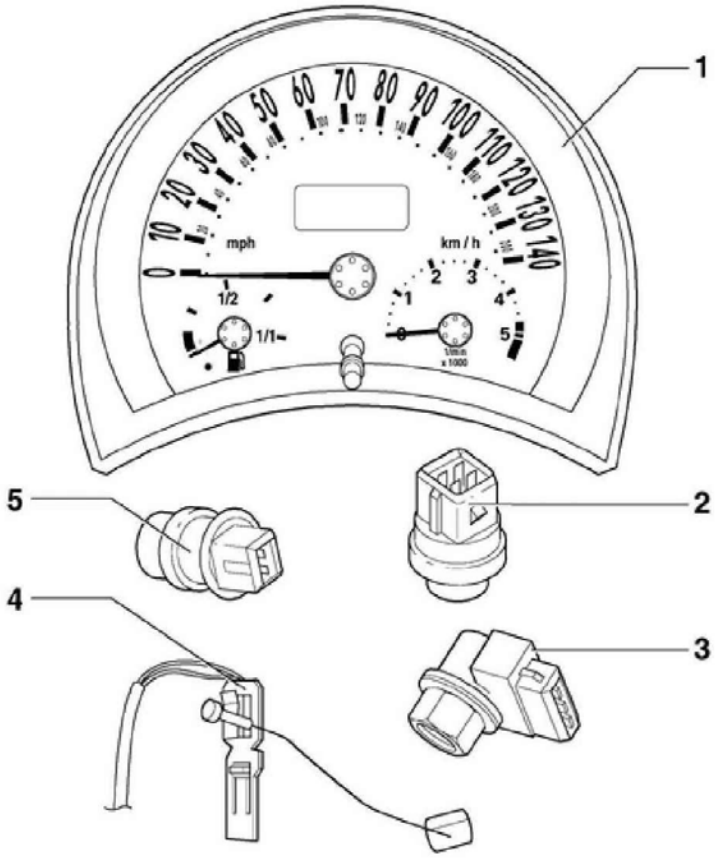


Fig. 12: Identifying Special Tools And Equipment
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Removing

NOTE: Always replace seals and gaskets.

- Drain coolant. See **COOLING SYSTEM, DRAINING AND FILLING** .
- Remove coolant hose from connection -2-
- Unscrew mounting bolts -1- of connection -2- and remove connection -2- along with thermostat -4-.
- Turn thermostat -4- 1/4 turn. (90°)to the left and remove from connection -2-.



1 - Instrument cluster -K-

2 - Engine coolant temperature (ECT) sensor -G2-

3 - Speedometer vehicle speed sensor (VSS) -G22-

4 - Sender for fuel gauge sender -G-

5 - Outside air temperature sensor -G17-

Fig. 13: Removing Thermostat
Courtesy of VOLKSWAGEN OF AMERICA, INC.

Installing

Installation is carried out in the reverse order. Note the following during installation:

- Moisten new O-ring -3- with coolant.
- Insert thermostat -4- in connection -2- and turn 1/4 turn (90°) to right.

NOTE: The brace on the thermostat must be almost vertical.

- Install thermostat -4- into engine block.
- Tighten mounting bolt -1- to 15 N.m (11 ft lb).
- Fill engine with coolant. See **COOLING SYSTEM, DRAINING AND FILLING** .